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SUPPLY OF WATER TO THE CITY OF BRISBANE,

By A. C. GREGORY, Esquire, C.M.G., P.Q.P.S.

(Read before the Queensland Philosophical Society, Brisbane, 8th August, 1878.)

One of the most important questions affecting the City of Brisbane is how to provide a sufficient supply of good water.

The Enoggera Waterworks were completed in 1866, but the distribution was at first confined to only a small proportion of the city, and the quantity of water delivered was comparatively small. The gradual extension of the distributing pipes resulted in an equivalent increase in consumption, and in 1871 it accumulated to 300,000 gallons per diem, or nearly the full quantity the 8-inch main was capable of conveying from the Storage Reservoir, and a second main of 12 inches diameter was laid, and for nearly two years the delivery of water to the city has been about 1,000,000 gallons per diem; but while the distribution has only extended to districts comprising 2,500 tenements, with an estimated population of 16,000, the consumption has greatly exceeded the available rainfall, and therefore cannot be long maintained under existing conditions.

During the twenty-two months which have elapsed since the present rate of supply to the city has been in operation there has been no overflow of the bywash of the Storage Reservoir, which was quite full at the beginning of the period, but was some four feet below at the end.

Thus the expenditure of water during the twenty-two months has been 200,000,000 gallons in excess of the natural supply, being at the rate of 300,000 gallons per diem over the capabilities of the Reservoir, with a rainfall of 36 inches per annum.

The area of the catchwater or watershed of the Enoggera Reservoir is 5,000 acres; the rainfall of the last two years has been 36 inches per annum, equal to 10,000,000 gallons per diem; while the quantity available for delivery to the city has only been 700,000 gallons per diem, or only one-fifteenth of the rainfall.

The distribution of the million gallons per diem supplied to the city is about 300,000 gallons to the lower division, with 5,000 persons, and part of South Brisbane, with an estimated population of 1,000, or a total of 6,000 persons, or 50 gallons per head ; while 700,000 gallons are delivered in the higher division of Wickham and part of Fortitude Valley containing 10,000 persons, being at the rate of 70 gallons per head.

It may be remarked that in the former district the 50 gallons includes street watering, while none of the streets are watered in the division where 70 gallons per head is consumed.

The census of 1876 shows nearly 22,000 as the population of the Municipality of Brisbane, with 9,000 in the adjoining suburbs, making a total of 31,000, of whom only 16,000 are within the range of the present water supply from Enoggera, leaving 15,000 unsupplied except by tanks and waterholes, which, as the population increases, are every day becoming more precarious and unwholesome sources.

Thus while the Enoggera Reservoir is being drained at the rate of more than 40 per cent. above its capability of continuous supply, there are still 15,000 persons yet to be provided with water, irrespective of the prospective increase of population, which from the census of 1876 may be computed at 13 per cent. per annum.

Having thus ascertained that the water supply from Enoggera is inadequate for even the present requirements, the question to be considered is, from what source is the deficiency to be obtained ?

On the northern side of the city the valley of Kedron Brook and the South Pine River present themselves ; but these watercourses occupy such depressed localities that it would involve the double expense of constructing storage reservoirs and pumping to raise the water to the higher portions of the city. The supply from Kedron Brook would be very small, and it would require at least 15 miles of main pipe to bring water from the South Pine River.

To the south, the Logan River would supply a large quantity of the best water in the Moreton district ; but as it would have to be pumped from a level scarcely above high-water mark, and conveyed a distance of 22 miles, the cost is an almost insuperable objection.

To the south-west of the city, the Brisbane River, above the tidal influence, presents a considerable volume of water of fair quality, which, though inferior to the Logan, is better than that from Enoggera.

The valley of the Brisbane is so nearly level that the tide carries salt water about five miles above the junction of the Bremer River, so that the first point at which fresh water could be obtained is 16 miles from Brisbane along the shortest practicable line on which pipes could be laid, the surface level rising to 170 feet above the river in several places, though there would not be much difficulty in reducing the level of the pipes to 120 feet by a few short tunnels.

The water from the Brisbane River would require to be pumped, as the rise of the valley for 60 miles above the head of the tide is less than six feet per mile, and following the course of the channel of the river it is only three feet per mile, the elevation of the river bed at Colinton being less than 350 feet above the sea,—a head of water insufficient to overcome the friction of pipes of more than 100 miles in length.

The Brisbane River is therefore unavailable as a source of supply by gravitation, and its waters would have to be pumped a height equal to the required point of delivery in the city, in addition to that necessary to overcome friction.

Now, a fall of five feet per mile is necessary to cause the delivery on one million gallons per diem through a pipe of 15 inches diameter, even when the bore is even and there are no bends; and five feet per mile for 16 miles is 80 feet, while the point of delivery in the city ought not to be less than 200 feet above the river: this gives 280 feet for the water to be pumped. To pump 1,000,000 gallons of water 280 feet high in twenty-four hours requires an engine of 80 horse-power working without intermission.

There is a workable seam of coal about six miles from the spot where the engines would be erected, and fuel might be obtained at about 15s. per ton; but the quality is inferior, and it would require about 10 lbs. of coal per horse-power per hour, or about 8 tons of coal per diem, costing say £6.

Sixteen miles of cast-iron pipes, 1 inch thick and 15 inches in diameter, would weigh 6,400 tons, which at £10 per ton delivered on the work would cost £64,000; laying the pipes would cost at least £30,000; engines, pumps, and accessories, not less than £16,000; making a total of £110,000. Six per cent. on this sum would be £6,600. Coal would cost £2,200 per annum; wages and contingencies say £2,200; making a total of £11,000 per annum, or about 7d. per 1,000 gallons, exclusive of the cost of renewals of engines and pipes.

The high cost of obtaining water from the Brisbane River indicates the importance of seeking some less expensive source of supply, especially as regards the contingency of pumping.

The upper valleys of Moggill Creek, from ten to twelve miles to the west of the city, appear to offer some important advantages over any of those localities which have been under consideration. The distance from Brisbane to Moggill Creek by the road is seven miles, but from this point on the creek it would be necessary to ascend the valley about five miles to obtain sufficient elevation to supply the city by gravitation. At this distance the valley of the northern branch of the creek has an elevation of about 270 feet, the highest point on the route from Moggill Creek to Brisbane being 170 feet, so that it would be practicable to deliver the water in the city at 200 feet above the river.

There is, however, only a distance of $1\frac{1}{2}$ miles between a bend of the creek and the Enoggera Reservoir, and the ridge is very abrupt, with a height of 190 feet above the Reservoir. About 20 chains of tunnel and 3 miles of pipe would be sufficient to convey water from the upper part of the north branch of Moggill Creek into the Enoggera Reservoir.

The watershed of the north branch of Moggill Creek, which would be available for a reservoir, is about 3,000 acres, while there is every facility for constructing the necessary works for storage.

In carrying out this work it is proposed to commence at the Enoggera Reservoir, and make a cutting in the slate rock for 20 chains, when it would reach a depth of about 30 feet; then to tunnel through the ridge separating Enoggera Creek from Moggill Creek a distance of 20 chains, and a second cutting of 10 chains, all having a rising grade of 10 feet per mile; and that for this total distance of 50 chains the water would flow in an open conduit, as the rock is sufficiently hard without lining with masonry, and thus the expense of more than half a mile of iron pipes would be avoided.

From this open conduit iron pipes would be laid down the ravine 50 chains to the north branch of Moggill Creek, and then up that valley about 150 chains to a point where the channel of the creek is about 25 feet above the surface of the Enoggera Reservoir, and there is a narrow gorge suitable for the construction of a dam, which, if made 80 feet high, would back up the water in the valley for about one mile, with a probable storage capacity of seven hundred millions of gallons.

The valley being narrower than that of Enoggera at the Reservoir, it would not be more costly to build a dam of 80 feet than that of 60 feet at Enoggera; and it is important both in regard to evaporation and freedom from weeds to secure the greatest available depth of water in storage reservoirs.

From the dam to the open conduit, a pipe nine inches diameter, with a mean fall of ten feet per mile, would deliver 400,000 gallons per diem, and as the additional head of water in the Reservoir would generally double the pressure, the pipe would deliver 600,000 gallons per diem.

The passage through the 50 chains of open conduit would improve the water by contact with the air, besides saving the expense of cast-iron pipes.

The most formidable item of this scheme is the tunnel between the Moggill and the Enoggera valleys, but as it would be only four chains longer than the principal tunnel already made on the line between Enoggera and Brisbane, and the rock cannot be of a harder description, the cost may be put at about £3,000, or £7 per yard forward.

The general character of the watershed from which the water would be collected is similar to that of the Enoggera Valley, and the quality would no doubt be identical.

In addition to this reservoir on the north branch of Moggill Creek, there is a site suitable for a second reservoir on the main branch of Moggill Creek ; but the waters would have to be conveyed by pipes a distance of four miles to the head of the open conduit.

The supply from each of these reservoirs may be fairly estimated at 500,000 gallons per diem in seasons similar to the past two years, when the Enoggera Reservoir has had a capability of 700,000 gallons per diem.

As regards the relative cost of obtaining one million gallons of water per diem from the Moggill Valley and the Brisbane River, it may be estimated that each of the Moggill Reservoirs and its accompanying works could be constructed for £50,000, while the first cost of the works for bringing the water of the Upper Brisbane to the city would be more than £100,000. In the former case the water would be delivered by gravitation at the highest level in the city, and in the latter it would have to be pumped 280 feet by steam power.

In seeking for sources of water supply, the possibility of its being obtainable from wells of the ordinary artesian class should always be considered ; for, though well water is usually deficient in "softness," this defect is generally more than compensated by the greater freedom from organic impurity. Ordinary wells are, however, only available for large supply where there are extensive beds of gravel or sand belonging to tertiary or recent alluvial drifts. Artesian wells can only be formed where there are inclined beds of porous material interspersed between permeable strata of clay and rock, conditions confined to formations above the carboniferous series of rocks.

The older Devonian slates and carboniferous shales of the district around Brisbane are so impervious that nearly the whole of the rainfall flows off by surface channels, there being no beds of sand or gravel to form subterranean reservoirs, while the rocks are so impregnated with iron pyrites that the small quantity of water retained in the small fissure is unfit for domestic use.

As wells are impracticable, and there are no copious springs, it is necessary to resort to storage of the surface drainage of the country either in natural or artificial reservoirs.

The Brisbane River is a natural reservoir of this character, not being supplied from springs, but consisting, in the dry season, of long reaches of nearly stagnant water, with a small flow over the intervening banks of sand and gravel resulting from the gradual drainage of the upper part of the channel.

Whether the storage be in these reaches of water, or in artificial reservoirs in the upper parts of tributary valleys, the direct source is in either case the surface drainage from tracts of forest land, and necessarily charged with a large proportion of vegetable matter, which, by its decomposition, especially in the hot season, is a fertile source of organic impurity ;—but this applies to all the available sources of supply for the city of Brisbane in nearly equal degree.

The purity of water stored in artificial reservoirs is greatly affected by the depth ; shallow water becomes so heated by the sun, that aquatic vegetation forms a dense mass wherever the depth is less than fourteen feet; where the depth exceeds fourteen feet it is free from weeds, the surface temperature does not rise so high, and evaporation is less.

It is therefore of considerable importance that, in selecting sites for reservoirs, the greatest practicable depth should be secured ; and it is therefore urged that if reservoirs are formed in the valleys of Moggill Creek, the dams should be raised higher than that at Enoggera, and that 80 feet would be quite practicable.

In connection with the question of supply, it may be convenient to advert to what seems to be an excessive quantity of water consumed in Brisbane.

In 1871 the lower district of the city consumed about 48 gallons per head for all purposes, including street watering ; and in the upper district 30 gallons per head. At the present time, the consumption in the lower district is 50 gallons per head, though street watering has been trebled; but in the upper district, where no streets are watered, the consumption has risen to 70 gallons per head.

Now, in the upper district not one-tenth of the houses have baths, and the average number of each household is six, and the consumption 420 gallons per diem, equal to 200 buckets of water, a quantity obviously in excess of what can be used ; and the only conclusion which can be arrived at is, that more than half the water delivered is allowed to run to waste.

If, instead of an annual water rate based on the size of the house, water were charged by meter, the consumption would probably be reduced below what is conducive to the health of the city; but it is probable that if a regular system of supervision and small fine were imposed for allowing water to run to waste, the consumption might be reduced to 30 gallons per head, a quantity estimated to be ample for all purposes in English towns.

If the consumption were reduced to 30 gallons, the present supply of one million gallons per diem would be sufficient for the 32,000 persons at present residing in the city and suburbs ; but the contingency of a rapidly increasing population demands that additional provision should be made for the future, and that, under any circumstances, the requisite sites for collecting grounds and reservoirs should be reserved from alienation in the case of Crown lands, or repurchased in the case of alienated lands before the value is enhanced by further improvement.

At present the alienated lands which will be required are scarcely occupied or improved even by fencing, but in a few years the clearing of scrub, and cultivation of portions of the land, will increase the cost of purchase to three or four times what it could now be bought for.

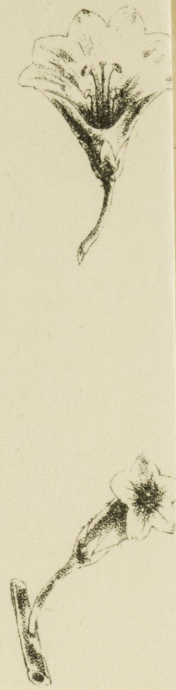
Mr. D. C. McConnel: As discussion or remarks in writing on the very important question of Brisbane Water Supply are asked, I take the liberty of reading this. No doubt, on such an important subject, every point of view should be examined. Having lived for very many years, since 1840, on the Upper Brisbane River, I recommend that the hottest part of summer should pass over, and the water collected from that river by the New Waterworks in Ipswich be well examined microscopically and chemically. I know that half way, or to its source about 60 miles from Ipswich, in summer the water is hot, impregnated with decaying vegetable and animal matter and infusoria—in fact, a strong decoction of dead prawns, &c., particularly in dry weather. About half way it is purer, but even 30 miles from the source the taste is disagreeable enough, barely fit to drink unless allowed to stand for a time, or be boiled and then cooled. The hotter and drier the season, the more disgusting is that decoction. It is probable that in every feeder there is some dead animal. I am pretty sure this will be very distinctly noticeable in the water obtained from that river in Ipswich, from December to March, unless heavy rain come. Although I dwell on this rather strongly, still I think there may be some remedies to which I shall soon advert, and the large volume of better water than the present Enoggera Reservoir supplies is a very important consideration.

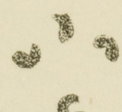
I quite agree with Mr. Gregory that there is not the slightest chance of any success in boring for artesian wells, particularly on the north side of the Brisbane River, as the rocks are primary, Devonian, and lower carboniferous. On the south side, beyond Goodna, there might be a chance among the sandstone strata, for water, but probably not enough for a large water supply: rocks are often interrupted by basalt. The North Pine and Caboolture sandstone is only a small and uncertain basin, and a long way off; so I agree with Mr. Gregory that artesian wells are out of the question. I can easily get water here, and have sunk three large wells down to the bed rock, about 15 feet to 18 feet deep. The water is most abundant, and about three or four feet from the surface, but not fit for human beings to drink, being much impregnated with sulphuretted hydrogen, probably from decomposition of iron pyrites in the soil and rock. I believe any amount of irrigation might be carried on in this neighbourhood: there is no deficiency of water for that purpose.

I should say there is no plan mentioned by Mr. Gregory comparable with that from the north and main heads of Moggill Creek, costing about £50,000 each and no pumping required, being about 280 feet high and able to gravitate down into the Enoggera Reservoir, and the two able to supply 1,000,000 gallons per diem at least. No doubt this is the best water obtainable from any quarter, and at far the least cost. It is said, and probably with truth, that in a few years the 2,000,000 gallons daily from Enoggera and the two heads of Moggill Creek will not be enough for our fast rising population. In ordinary seasons there might be sufficient, but for unusual dry seasons, say three months out of the year, more is required. My idea is, that in those unusual seasons, certainly not required at present, a steam-engine be placed on Brisbane River about Ugly or Kholo Creek, and in those very dry seasons, or perhaps ten years hence, water may be forced by pipes about four (4) miles into the head of Moggill main creek. I think such a supply is feasible, and would suffice for the present generation—in fact, even after. The expense of such a plan, as it is in operation for only three months out of the year, and is only for four miles, would be less than half of what Mr. Gregory states as the cost of the Upper Brisbane supply. It has other great advantages—that the water from Upper Brisbane, not most excellent in quality, could be lifted to a higher, cooler, and deeper reservoir at Moggill, and there exposed to air, in at least three different reservoirs, before going to Brisbane, and thus be rendered quite fit for use. In the large London waterworks there are always several large purifying reservoirs, which can be changed and cleansed as often as needed. In making reservoirs at Moggill, this should be borne in mind. The reservoirs near London are, of course, watertight, and the Thames water used is allowed to settle in one or two before use ; and as there are several reservoirs, some one or two are cleaned in their turn.

With the present Enoggera improved if possible, the two Moggills, with plenty of exchangeable reservoirs, and in dry weather Upper Brisbane water pumped up, I don't think we shall have anything to dread either for quantity, quality, and certainty of supply.

Of course, all the necessary area of land for collecting and storage of water on Moggill heads should be reserved.





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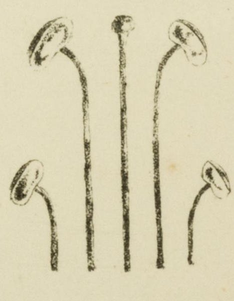

Stamens

Duboisia Pituri, Bancroft.

The Philosophical Society of Queensland herewith transmits to you a short history of Pituri and the allied plants. Pituri grows in Central Australia: it is chewed by the aborigines, who trade with it far and wide. It has recently been analysed, and found to have similar properties to Tobacco. No plants of it are under cultivation in Australian gardens. The other members of the genus *Anthocercis* widely scattered over Australia are desirable for examination. It is hoped you or your friends may be able to forward to this Society ripe seeds of some of these plants; also, small quantities of the dried herb—one ounce, more or less, by post.

I have the honour to be,

Your obedient servant,

A. C. GREGORY,

President.

PITURI AND TOBACCO.

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(*Read before the Queensland Philosophical Society, by Joseph Bancroft, M.D., September 4th*, 1879.)

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In March of 1872 I had the honour of reading before this Society an account of the first experiments made with the Pituri of our aborigines. I was so startled by the toxic energy of the substance that my paper was headed "The Pituri Poison." The details of that paper I need not now recount. For five years afterwards no clue could be found to ascertain what plant produced the Pituri that the Central Australian man held in such high estimation, though Mr. Bailey, our botanist, and Baron von Mueller, were put frequently on the rack by my inquiries and specimens transmitted. The plants, however, which Hodgkinson, the explorer, collected in 1877 were not ground into particles, as is the condition of the Pituri procured from the natives. So, after I had ascertained that these specimens had the same poisonous properties as the natives' Pituri, they were forwarded by Mr. Bailey to Baron von Mueller, who at last was able to clear up the mystery and tell us that the plant was *Anthocercis* or *Duboisia Hopwoodii.* The learned Baron's suggestion for me to examine *Duboisia myoporoides* led to the discovery of that curious mydriatic now establishing itself as a potent remedy in Ophthalmic practice in Europe.

My second paper on "Pituri and Duboisia" relates these interesting circumstances; but now with regard to Pituri some information has recently come to hand which it is the object of this paper to detail.

On my trip to Europe lately I submitted the Pituri to Professor Fraser, of Edinburgh, the discoverer of the mydriatic property of Calabar-bean; later on I gave specimens to Dr. Sydney Ringer, the author of the celebrated hand-book on therapeutics; and to the eminent Parisian chemist, Mons. Petit.

The results of the experiments of Professor Fraser are not yet to hand; Dr. Ringer's article in the *Journal of Physiology* is commented on in the *Lancet* of December 21st, 1878. (The original paper I have not been able to get.) And Mons. Petit nas given in the *Pharmaceutical Journal* of April 5th, 1879, an account of his findings, from which the following is extracted:—

Last year, Dr. Ringer having received a very small quantity of pituri, handed it, for the purpose of medical examination, to Mr. Gerrard. Mr. Gerrard recognised that pituri contained an alkaloid, and notwithstanding the small quantity at his disposal he has been able to determine some of the properties of this product, to which he has given the name "piturine." Dr. Bancroft having sent to me, through Messrs. Christy and Co., of London, a larger supply of pituri—about fifty grams—I have been able to take up and complete the experiments of Mr. Gerrard.

The aqueous extract dissolved in water was treated with bicarbonate of potash and ether. The ether was freely alkaline; agitated with water to which dilute sulphuric acid was gradually added, it gave up the alkaloid to the aqueous solution. Several treatments with ether are necessary to exhaust the aqueous extract. The water, containing in solution the sulphate of the alkaloid, was separated and treated afresh with the bicarbonate and ether. After three treatments there was obtained by evaporation of the ether a scarcely coloured residue, possessing energetic alkaline properties and presenting all the reactions of the better defined alkaloids. It gave off an irritating odour, especially when heated slightly, and was very pungent to the tongue. Upon bringing strong hydrochloric acid close to the surface of the liquid, dense fumes were formed. Placed in a watch glass upon a water-bath, it volatilized rapidly. It was therefore a *volatile alkaloid.*

The properties above described raised the inquiry whether the alkaloid was not nicotine. Some pure nicotine was therefore procured, and various comparative experiments have been made with the two substances.

In order to remove any water which the alkaloid derived from pituri might contain, after careful evaporation, it was left during forty-eight hours in a vacuum over sulphuric acid. Under these conditions nicotine and the alkaloid from pituri gave exactly the same result. Only having at my disposal about 1·5 gram of alkaloid, I was unable to take its boiling point.

Rotatory Power.—0·236 gram dissolved in 10 c.c. of 98° alcohol gave with the polarimeter 5·85° with a column of 20 centimetres, being for the yellow light a rotatory power of - 123·9°, whilst the rotatory power of nicotine is, according to Buignet, - 121·9°. When saturated with sulphuric acid the rotatory power of pituri passes to the right, as in the case of nicotine.

Alkalimetric Power.—2 c.c. of the preceding solution were saturated with titrated sulphuric acid. The results calculated to 10 c.c. gave: 1st experiment, 0·07 gram H_2SO_4; 2nd experiment, 0·0725 gram H_2SO_4. These figures calculated as for nicotine gave 0·2312 gram and 0·2396 gram, or a mean of 0·2359 gram, a figure practically equal to the amount of alkaloid employed.

Chloroplatinate.—Dissolved in water and saturated with hydrochloric acid in slight excess, the alkaloid of pituri gave upon addition of chloride of platinum exactly the same crystals as those of the chloroplatinate of nicotine; that is to say, in dilute solution, flattened prisms with parallelogram base. This chloroplatinate, which is represented by the formula $C_{10}H_{14}N_{2}2HClPtCl_{2}$, having been dried at 115° C. during four hours, gave upon analysis—platinum, 34 per cent.; chlorine, 36 per cent. The calculated number for chloroplatinate of nicotine are—platinum, 34·4 per cent.; chlorine, 37 per cent.

The other reactions are absolutely the same as for nicotine. I would mention, however, particularly that relative to the formation of iodo-nicotine. Upon mixing together ethereal solutions of iodine and of the pituri alkaloid very fine crystals similar to those of iodo-nicotine are rapidly formed.

The alkaloid prepared by Mr. Gerrard has been experimented with in London by two able physiologists, Messrs. Sidney Ringer and Murrell. The phenomena observed confirmed in an evident manner those described by Claude Bernard in his memoir on Nicotine:* augmentation of the number of the respirations, which became painful and diaphragmatic, an unsteady gait, convulsive contraction of the muscles, rigidity of the limbs, and all there described. A remarkable circumstance is mentioned by all three observers: the animal appears blind and the eyeball seems to be reversed so that the pupil cannot be seen. But in examining this phenomenon more closely Claude Bernard had observed, before Ringer and Murrell, that it was due to tension.

The alkaloid of pituri is therefore nicotine.

M. Petit, in thus announcing the identity of piturine with nicotine, gave me a great surprise. Some comparative experiments I have just made on animals with extract of Pituri and Tobacco go far to confirm the view of M. Petit. The Pituri extract is, however, very much stronger than Tobacco extract; pure nicotine I am unable to get in the colony. The remarkable contraction of the ocular muscles in the case of dogs suffering from Pituri was observed by me and recorded at page 12 of my paper on Pituri and Duboisia as follows:—"The extreme retraction of the eye-ball in dogs is very remarkable." There is no mention of this effect in the ordinary medical works as produced by Tobacco, though it appears to be recorded in Bernard's paper quoted by Petit, a copy of which I have not seen. I would suggest to experimentalists in Europe to make further observations on this phenomenon, and inquire if the alkaloids that resemble nicotine have any similar action on the eyes of dogs. After injecting a large dose of Pituri a dog's eyes are lost to sight, only duplicatures of the conjunction being visible. The dog may be quite sensible, wag his tail, and follow the sound of the voice, but the eyes remain quite buried in the orbit by the same muscular retraction one sees at any time when an attempt is made to touch the eyes of these animals.

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* Leçons sur les Substances toxiques et médicamenteuses.

I hope some future day to give a comparative account of the phenomena produced by piturine and nicotine. At present very little Pituri can be got, and the plant is not under cultivation. The nearest place we know it grows—Eyre's Creek—is 800 miles from here in a straight line. Hodgkinson's Pituri was gathered on the Queensland border, latitude 22° 52′ 51″, longitude 138°.

In many parts of the interior, from Cooper's Creek to the Gulf of Carpentaria, the Pituri grows, and several persons engaged in establishing new stations in the Western country hear it spoken of by the aborigines, but very few know the tree, as the natives avoid giving any information about it. A letter about Pituri, published in the *Queenslander* recently, is so interesting that I quote it here in full :—

PITURIA.—We are indebted to Mr. Sylvester Brown for the following very interesting paper, which has been a long time in reaching us, being dated "Sandringham, Sylvester Creek, 10th December," and having only just come to hand :—

Pituri-land is so little known that perhaps a short description of the shrub, its locale, and manner of growth may prove interesting. I am moved to this from perusing in a recent *Queenslander* (dated October 19) that Dr. Bancroft, of Brisbane, has lately read a paper on the subject at a meeting of the Queensland Philosophical Society.

I have during the last few months passed several times through the belt of country in which pituri has hitherto only been found. It is situated, so far as my means of observation serve, with the 138th meridian of east longitude passing through the belt about the middle, and I have met with the shrub anywhere in the vicinity of the longitude mentioned between the 23rd and 24th parallel south latitude, with a depth of fifty miles east and west. The pituri shrub, when full grown, is about 8 feet high, and the wood at the thickest part of the stem is up to 6 inches in diameter. When freshly cut the wood has a decided smell of vanille. It is very light and close-grained ; colour, lemon. Dr. Bancroft's guess as to the seed is so far correct that the berry (which, when ripe, is black and like a small black currant) has inside very minute kidney-shaped seeds. I have secured some of the seed, picked by myself from the growing tree, and hope, when passing through Brisbane, to let Dr. Bancroft have an opportunity of continuing his investigation of this rare plant by endeavouring to grow some of it. I have also cut some samples of the wood which I shall bring down unless absorbed, specimens and all, by early floods *en route*. I formerly heard many wonderful accounts of the rarity of pituri, and the great difficulty of procuring it. These absurd reports were strengthened by the extreme value placed on it by inside blacks, who could only obtain it by barter. "It grew on a rocky mountain in the Stony Desert, jealously guarded by the owners of the soil, who, in their periodical trips to obtain a supply, would have to carry three days' water in coolimans and paddymelon-skin waterbags." I also heard that it "grew only on a small extent of ground not exceeding twenty square miles ;" whereas the fact is that it grows on the ridges of high spinifex sandhills, and which sandhills contain many cool springs and lakes, which will hold water much better than the fabulous stories told of pituri.

There is one beautiful lagoon, with two smaller ones, just about the South Australian border, on or about the 23rd parallel of latitude, which—the blacks averring that it had never before been visited by white men, or "Pirri-birri," as they call them here—I took the liberty of naming "Pituria lagoons." The water in these lagoons is beautifully clear and soft, and when full they will last nearly, if not quite, two years. Pituri grows on the sandhills round them. Should the Government wish to make a pituri reserve, here is the place for it. The country in the vicinity is of no use for pastoral purposes, so a reserve of about twenty miles square, or 400 square miles, would be a cheap concession.

The blacks break off the pituri boughs and tie them up in netting till dry; then when thoroughly dry they break the leaves up and enclose them in closely netted bags in the shape of a crescent. These are easily carried for the purpose of barter, which is carried on as far as Cooper's Creek and the Barcoo. Before chewing they burn the leaves of a shrub they call "montera," and moistening the ashes mix and chew. I have not noticed any abnormal result from the habit, though I have heard that a black unaccustomed to the weed becomes intoxicated thereby. I have some young plants in a box, which, if they grow, I shall endeavour to bring down, but, as they have a journey of 1,000 miles before them overland, the result is more than problematical, even should they elect to grow in the box. I am rearing one plant, which seems to be growing well, in my garden at the station. The seeds, however, may grow, and to facilitate selection of a proper soil I shall bring down a sample of mother sand for analysis. The suckers grow from long rough roots, which run about under the sand and throw up shoots as they go.

I have to thank Mr. Brown for some ounces of carefully dried Pituri in flower, from which the drawing herewith was made. The seeds did not germinate, though cared for most diligently: they were probably immature. The berries of the Pituri bush most likely fall off directly they ripen, as I find to be the case with *D. myoporoides*.

Mr. Wiltshire kindly forwarded me the following on Pituri and smoking:—

For many years I have by hearsay been acquainted with the properties of pituri. In South Australia, in the neighbourhood of Lake Hope, the natives procure it from other natives making their annual visit South for the red ochre so valued by them. On questioning the visiting natives, who have all the marks of long travel, as to where pituri grows, I found them wonderfully reticent, the only answer I received being an indication by a motion of the hand in a Northerly direction and a rattling noise made in the throat intended to signify that it was a long way from there. It is much sought after by the natives, who will give anything they possess for it—not for the purpose of exciting their courage or of working them up to fighting pitch, but to produce a voluptuous dreamy sensation. I have heard of pituri producing a fierce excitement, but I have never seen it, as far North as I have been. It may be that there are other plants that will produce the latter effect, but I have never seen or heard of them. Going into the interior from the coast about 16° or 17° south, you will meet natives whose "possible sacks" or "dilly-bags" contain frequently pituri or something very like it. On making them understand that you wish to know where it grows, they will point southwards and say "tir-r-r-r-r-r," meaning a long way. This, I am inclined to think, is the same plant as is used by their countrymen in the South.

Pituri is valued at as high a rate in the North as in the South, and cared for accordingly. In the north it is not unusual to find a description of mild tobacco in the dilly-bags of the natives along with a pipe or pipes—one kind being not unlike a cigar-tube made by the Toredo navalis in perforating the roots of the mangroves, destroying the root and leaving a shelly crust behind it; but as this description can only be procured on salt water, natives in the interior make a rude pipe of a soft stone, the tube usually very short, of a pithy wood or a joint of a reed. I think it very likely that the natives have acquired this habit from Europeans, as we know that the "Beagle" was at anchor in the Victoria River for some months, thirty years ago, and it is possible that the crew communicated with the natives, as they had plenty of time and opportunities. Such a novelty as smoking would be sure to find adopters among the tribes in the vicinity. As for tobacco, they would naturally, after exhausting their small supply, try the plants around, till one was found with the necessary qualities. The pituri proper, I am inclined to think, grows between the latitudes of 21° to 29° south, in poor and sandy soil.

There were other novelties in the dilly-bags of the natives at times which we did not understand and the owners would not, in a few cases explain, as they persistently kept out of sight.

In the *Lancet* of January 18, 1879, a letter from Dr. Murray appeared, and I have his liberty to use it in any paper I may write on the subject:—

Seeing a notice of pituri in your journal of December 21st, 1878, I at once recognised an old friend about which I picked up a few interesting facts while travelling many years ago in Central Australia.

First, with regard to name: "pituri" appears intended, but fails, to convey the native sound of the word. Howitt, the able leader of our party, who spoke the Cooper's Creek dialect fairly well, always spelt it "pitchery," which conveys the true sound, the accent being placed upon the antepenult "pitch," as in almost all trisyllabic words of this langauge. "Pitch'ery," therefore, or the more modern form, "pitchiri," is correct if it be desirable to maintain the native pronunciation of such words.

This substance was apparently unknown in 1862 (the year of Howitt's expedition) to natives south of the drainage line of Cooper's Creek, which trends S.W. from its sources in the dividing ranges of Queensland (lat. 23°, long. 145° about) to its terminal expansion and desiccation in South Australia (lat. 30°, long. 137° about). It is probable that its use formerly extended south of this boundary, and that it receded before the white man's tobacco, now the chief luxury and current coin amongst the blacks of the out settlements. We often questioned the Cooper's Creek natives as to where they got their pitchiri, and they invariably pointed northward as the quarter it came from, using at the same time the words "tooch, tooch," "far away, far away." Howitt discovered that they traded regularly for it with the natives beyond Sturt's stony desert, and he found it convenient, on account of water, to follow their trading track in one of his exploration trips from our depôt, or Cooper's Creek, to Wills' Creek beyond the desert (from about lat. 27° 50′, long. 141° 5′, to lat. 25° 48′, long. 130° 30′). Referring to this journey, he says, in a despatch from Angipena, South Australia, dated September 2nd, 1862 :—"The track I followed across the desert is one made use of by the natives of Lake Hope, Cooper's Creek, and Kyejeron on their journeys to procure the *pitcheri*, so much used by them as a narcotic, and on this account I conclude that it is the shortest route known to them." It is, I think, quite certain that this plant does not grow on Cooper's Creek, else the natives would possess it more abundantly, and would have pointed it out to us when so frequently questioned on the subject. Thus they made no secret of showing us their *nardoo*, *papa*, and *bowa* seeds, nor objected to inform us about their edible fruits, herbs, roots, and ground-nuts, although one would naturally expect them to be jealously watchful of every ounce of food in so inhospitable a country. Pitchiri, in short, was so scarce amongst the Cooper's Creek tribes that they parted with only small quantities in barter for wax matches, which was our golden currency. The men carried it in small skin bags tied round their necks or under the axillæ, but I never noticed the women with any. They never travel without it on their long marches, using it constantly to deaden the cravings of hunger and support them under excessive fatigue. King, the survivor of the Burke and Wills expedition, who had lived seven months with these natives when rescued by Howitt, states that when his food became so scarce and bad as barely to support life, he sometimes obtained a chew of pitchiri, which soon caused him to forget his hunger and the miseries of his position.* It also plays an important part in the social rites of these natives. At their "big talks" and feasts the pitchiri "quid"—for I can find no more appropriate word for it—is ceremoniously passed from mouth to mouth, each member of the tribe having a chew, from the *pin'aroo*, or head man, downwards. This singular wassail cup never fails to promote mirth and good fellowship, or to loosen the tongues of the eloquent. I have not been able to ascertain if the excitement it produces can be pushed to actual intoxication, or whether natives suffer from its use. There is a curious mode of greeting on Cooper's Creek. When friends meet they salue with "*gaow, gaow*" ("peace, peace"), and forthwith exchange pitchiri "quids," which when well chewed are returned to their owner's ears ! They extended this custom to us ; but the fullest appreciation of their hospitality in offering their highly-prized and indeed only stimulant could never overcome our repugnance to the nauseous morsels hot and steaming from their mouths. I may add, they always accepted our want of politeness good-humouredly. The "quid" which I have spoken of, which is carried behind the ear, is composed of pure pitchiri, green leaves, and wood-ashes. The pure pitchiri I saw resembled unmanufactured tobacco of a very coarse kind, dried and pulverised. It had the same brownish colour; but

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* See King's Narrative in the History of Burke and Wills' Expedition.

the stalks and midribs, which were strong, preponderated over the finer parts of the leaf. I could never obtain an unbroken leaf nor even a good piece of one as a specimen. It had no particular smell, but a most pungent taste, which to me appeared like tobacco, and chewing it promoted a copious flow of saliva. The natives take a good pinch of pitchiri, and knead it with green leaves, I think to increase the size of the masticatory and moderate its power. We know that the Malays add sirih-leaf (*Piper betel*) to their areca-nut, and lime to increase its stimulant properties ; but I could never discover the use of any condiment in this way by the Cooper's Creek blacks, all non-poisonous leaves appearing to be used indifferently. By the addition of wood-ash to the masticatory, the alkaloid is slowly liberated, and thus the strength of the "bolus" gradually augmented by keeping, as noticed in the *Lancet's* annotation. Natives, on using our tobacco, call it "whitefellow pitchiri," and, conversely, some whites who smoked pitchiri pronounced it a good substitute for tobacco. From these confessedly rough and ready data I have always up till now regarded this substance as a variety of *Nicotiana*. Its toxic action and that of tobacco, to judge by the experiments of Dr. Bancroft, are singularly alike ; for the successive stages of mild cerebral excitement, loss of inhibitory power, copious salivation and subsequent dryness of mouth, irregular muscular action, nausea, dilatation of pupil, languor, drowsiness, and paralysis of the respiratory functions of the medulla appear in both. But the experiments of Drs. Ringer and Murrell with alkaloid of pitchiri point to marked physiological differences between it and nicotia, more especially in the pupil indications. I must leave the discussion of these nice points to competent hands, as I aim no higher in this letter than to give a traveller's account of pitchiri.

Dr. Murray records the fact of using Pituri in lieu of Tobacco. Hodgkinson mentions the same in page 11 of my former paper. He says:—"Sixteen years ago, when with Burke and Wills' expedition, subsequently with Mr. Jno. McKinlay, and recently in the North-west Expedition, I used petcherie habitually, when procurable, in default of tobacco, and have very often chewed it both in its raw and prepared state." Thus, all evidence, practical and theoretical, goes to prove the identity of the two alkaloids Piturine and Nicotine ; and it is a marvellous circumstance that the black man of Central Australia should have dropped upon the same narcotic principle as the red man of America in a plant differing so remarkably in external aspect. This discovery of the Australian aboriginals should tell somewhat in their favour as clever men, against the oft-repeated assertion of ethnologists as to their low position among the human races. The aborigines value not the nick-nacks and contrivances of the white man, yet are very much amused when the utility of such tools is explained to them. The forest is the home of the native, and there the white man often feels his own inferiority. In the wilds of Australia the blackfellows' power of climbing easily, puts him in possession of a meal under circumstances in which a white man must starve. As a hunter the black man is perfection itself.

With regard to Tobacco and Pituri, humanity at large has endorsed the conclusions arrived at by the uncivilised man. The first thing now offered by the European traveller to a newly-discovered savage race is tobacco. I was much struck with this Tobacco-want when passing through Torres Straits lately. Steaming slowly among the islands of that calm sea the vessel encountered a native and his wife in a bark canoe. The only word they used was "Tabac, tabac!" A loaf of bread was thrown to them, but this did not satisfy; and in the wake of the steamer there could still be heard the cry, "Tabac, tabac!"

Inhaling burning vegetable fumes is mentioned by Herodotus, Diosorides, and Pliny, for particulars of which consult Pereira's Elements of *Materia Medica* and references given; and Catlin, in his "North American Indians," p. 234, tells us:—"There are many weeds and leaves and barks of trees which are narcotics, and of spontaneous growth in their countries, which the Indians dry and pulverize and carry in pouches and smoke to great excess, and which in several languages, when thus prepared, is called 'K'nick-k'neck.' These are smoked in pipes made of red steatite, from the celebrated pipe-stone quarry. But the combustion of dried tobacco leaves, without doubt, originated in tropical America. "When Columbus and his followers arrived at Cuba in 1492 they for the first time beheld the custom of smoking cigars"—see Pereira; and, according to Loudon, "Sir Walter Raleigh first introduced smoking; in the house in which he lived at Islington are his arms on a shield, with a tobacco-plant on the top." The universal use of Tobacco in Asia has led some moderns to think the practice must have been an old custom. But the following from an Indian work in the library of the Royal Asiatic Society at Bombay seemed so conclusive that I copied it in my note-book:—

Punjab products, vol. 1. Baden H. Powell, Roorkee, 1868, p. 288.
Tobacco—Tamákú. First known in 1492 by Columbus and his followers.

The universal practice of smoking in the East is very remarkable, but it has been introduced: not only is there no indigenous wild species of tobacco in Asia, but there is evidence to show that it was not introduced before the 17th century. Lane says that tobacco was introduced into Turkey and Egypt in the 17th century, and to Java in 1601.

It would seem from the remarkable facts about Tobacco and Pituri that some important cravings of human nature are satisfied by the narcotic principle; and though Burns says of alcohol—

> Inspiring bold Sir Barleycorn!
> What dangers thou canst make us scorn!
> Wi' tippenny, we fear nae evil;
> Wi' usquabae we'll face the devil!

yet there is no narcotic in the world the use of which has been so satisfactory to humanity as Tobacco.

For all this, nicotine has scarcely been used in medical practice; its medicinal dose is not even determined. Infusion of Tobacco 20 grs. to 8 ozs., in the form of an enema to relieve strangulated hernia, is mentioned in the British Pharmacopœia. Tobacco is spoken of unfavourably in medical writings; and, though its action is very like that of Digitalis, it is dismissed in two pages of Dr. Ringer's book on therapeutics, whereas thirty pages are devoted to the history of the use of Digitalis. Professor Haughton, quoted by Waring in his work on therapeutics, advises the employment of nicotine in preference to the use of crude Tobacco infusion, and his suggestion is well worth the attention of experimentalists.

The study of the peculiar retraction of the eye of dogs suffering from nicotine may tend to elucidate the nature of the amaurotic blindness that happens to some smokers. Children suffer in health from tobacco-smoking to a greater extent than adults whose organs are more firmly developed.

Gilmour, now dead, told me that the aborigines at Kulloo, Eyre's Creek, who use Pituri, keep it entirely from the younger members of the tribe. Are these poor Australians not, then, on a parity in intelligence with the latest of our anti-tobacco societies who are recommending legislation against youthful smokers? Tobacco has a well-marked soothing effect sufficiently evident in its operation on others. I do not speak from personal experience, as I neither smoke nor enjoy the fumes of Tobacco. If one could believe Hood's poetry on "my Cigar," the use of it becomes intelligible to non-smokers. A few days ago I was called to tie the radial artery of a young fellow on board a steamer just arrived in the river, and from his bloodless and exhausted condition it was not prudent to give him chloroform. The patient was enduring much pain from multiplied bandages put on to control the bleeding. "If you will only allow me to smoke," he said, "I will bear the pain of the operation." He accordingly had his pipe filled and lighted, and he submitted to the operation with as much quietude as if chloroform had been administered. Powdered Pituri acts powerfully like snuff; one finds this out in handling that prepared by the natives, much of which is comminuted and dusty.

The narcotic *Solanaceæ* and *Scrophulariaceæ*, widely scattered over Australia, are objects of much interest, and I have to request the Queensland Philosophical Society to aid me in endeavouring to obtain them for examination. *Duboisia Hopwoodii* should be known by the aborignal title; I propose, therefore, to name it *Duboisia Pituri.*

Another suspected *Duboisia* is called *Anthocercis Leichhardtii;* but to its habitat there is no clue. The corolla lobes are said to be more acute than those of *D. myoporoides*, but the foliage is similar. *D. myoporoides* is a common plant in the neighbourhood of Brisbane. All the species of the genus *Anthocercis* are interesting; the plate herewith will enable observers to find them. I have completed my examination of two only—*A. Tasmanica*, sent me by F. O. Cotton, Esq., of Kelvedon, Tasmania, and *A. viscosa*, obtained from Dr. Schomburgk, of the Adelaide Botanic Garden. Baron F. von Mueller has given me all he can spare from his herbarium of the other species, but the quantities are insufficient for complete physiological experiments. I should therefore be pleased to obtain about an ounce or more of the dried plant of all the species except the two mentioned as examined, also ripe seeds of all the species. It would be interesting to find some with the properties of Pituri; so far as examined, all appear to have an action like that of *Duboisia myoporoides*. Persons searching for Pituri should take particular notice of the plate and the following description:—

The Pituri grows about fifty miles east and west of the 138° meridian, the boundary between Queensland and South Australian territory, and from 22° to 25° south latitude. It is a shrub or small tree about 8 feet high, with a stem at the thickest part at times as much as 6 inches in diameter. Wood light, close-grained, lemon-coloured 8 feith a smell of vanille when newly cut. Suckers spring uas 6und the tree from long rough roots spreading near the surface. Leaves 3 to 3½ inches long, pointed at both ends, ¼ inch wide, midrib distinct, margin slightly recurved. Flower a funnel-shaped tube from ¼ to ⅜ of an inch long with five bluntish divisions spreading to about ¼ inch across. Three reddish lines run from each division down the throat of the flower, making altogether fifteen stripes. There are no hairs in the flower as in the genus *Myoporum*, which latter may be known by having four or five stamens of equal length. The pistil of the Pituri extends to the length of the two longer stamens. Stamens four, two long and two short anthers yellow kidney-shaped, filament attached to the concave side, the anther bursting along the convex margin; best seen by examining a flower that is just at the point of opening. Fruit a green berry resting in the minute calyx. As it ripens it changes to black, and contains dark-brown kidney-shaped seeds covered with minute pits recognisable by the aid of a pocket lens. Ripe berries soon fall off, and should be looked for under the tree, as those gathered from the branches are not mature enough to germinate.

Plants of the genus *Anthocercis* may be known by the corolla lobes spreading out in a radiate manner, the word "*anthocercis*" meaning wheel-flower. The stripes running into the tube of the corolla are similar to the flower of Pituri described; the stamens also are four, two longer than other two; the lobes of the outer cup calyx are much sharper and prolonged. The fruit is a capsule opening by two valves, with two teeth on each; seeds, more or less kidney-shaped and pitted. Herbs, shrubs, and small trees; there are eighteen known species, which are described in the "*Flora Australiensis*;" it is also desirable to examine for poisonous properties the two plants of the genus *Anthotroche*—one *Lycium* and the varieties of *Nicotiana suaveolens*, called native tobacco.

It might be asked whether any interesting alkaloid exists in the genus *Solanum*, of which fifty species are described in the "*Flora*" as natives of Australia. In reply I can say that some of them have been tested in various ways and found poisonous. They have no immediate effect on the eye, nor do they produce the tetanic fits of Pituri, but a dangerous torpor with very feeble circulation and respiration. My experiments on this genus as yet are very incomplete and afford no reliable data.

Pituri seeds are very likely to perish by much drying. Collectors should forward them as early as possible by post.

Distribution of Anthocerces and Duboisiæ.	West Australia.	South Australia.	Victoria.	N. S. Wales.	Queensland.	Tasmania.	New Caledonia.
A. viscoea, oo	King George's Sound						
A. littorae, oo	King George's Sound and Swan River						
var. ilicifolia	Swan River						
,, glabella	do.						
A. gracillis, oo	do.						
A. genistoides, oo	Murchison River						
A. arborea, oo	do.						
A. intricata, oo	do.						
A. racemosa,o	do.						
A. fasciculata, oo	Phillips River						
A. microphylla, o	Salt River						
A. anisantha, oo	West Australia	Boston Island and Lake Gillies					
A. angustifolia, o	...	Torrens River					
A. myosotidea, o...	...	Murray River, Tattiara Creek	Grampians, &c.				
A. Eadesii, o	...	Tattiara county	do.	near Camden			
D. Hopwoodii—Pituri, o ...	West Australia, with smaller flowers	Queensland border	...	Darling River (rare)	Western boundary		
A. scabrella, o	...	...	...	Nepean River			
A. albicans, o	...	...	...	Bathurst, Cassilis			
var. tomentosa	...	...	...	Peel's Range			
A. or D. Leichhardtii, o ...	...	...	...	...	Queensland		
D. myoporoides, o	...	...	...	Port Jackson	Coast country	...	New Caledonia
A. Tasmanica, o	...	...	...	...	...	Kelvedon	
22 Species and Varieties ...	13	5	2	6	1	1	

o Species with single anthers. oo Species with double anthers.

EXPLANATION OF PLATES.

——o——

PLATE 1—THE PITURI PLANT :—

Flower cut open, natural size.

Enlarged appearance of stamens and pistil. Drawn by Dr. Bancroft from specimens supplied by Sylvester Brown, Esquire.

PLATE 2 :—

1. Enlarged flower of Anthocercis Tasmanica.
2. Ditto ditto ditto.
3. Ditto ditto ditto, open.
4. Enlarged stamen showing the anther bursting.
5. Ditto ditto ditto.
6. Enlarged pistil and germe.
7. Magnified hairs that cover the same plant.

   (1 to 7 copied from Hooker's Flora of Tasmania.)

8. The Natives' Pituri bag, showing the broken-up state of the prepared Pituri leaf, falling out; the loop of string for carrying the bag over the shoulder. The bag is made of fibre in the form of a circular mat, which is then folded and sewn up at the circumference, leaving an opening near one end about two inches long, which is sewn and unsewn as required.
9. Anthocercis ilicifolia, after Loudon.
10. Anthocercis viscosa, ditto.

    (Plate 2 drawn by Mr. Barton.)

By Authority: JAMES C. BEAL, Government Printer, William street Brisbane.


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THE WESTERLY WINDS OF BRISBANE;

MAY TO SEPTEMBER.

(Read before the Queensland Philosophical Society, by Mr. Jas. Thorpe, May 20th, 1880.)

THE interior of the Australian Continent has been sufficiently explored to warrant the assertion that there exists no extensive mountain range or elevated plateau therein which would account for the coldness of the winds supposed to blow from thence to our coast. The questions then arise, "Whence do these winds blow? How can we account for their coldness and dryness?" In the paper which I have the honour to read to-night I shall endeavour to reply to these questions, and to support the theory I advance by facts collected from the "wind and weather reports" of this and the adjoining colonies.

These winds, of which we get about six during the winter months—from May to September—blow with great force, have little humidity, and *seemingly* reach us from the western interior of the continent. I say "seemingly" because a series of observations of the weather reports of Queensland stations show the apparent anomaly that whilst a strong westerly wind is felt in Brisbane, stations to the west of us do not feel it so strongly; in fact, the further west we travel—*towards the apparent source of this wind*—the lighter does it become, until at length the direction of the current completely changes. As an example, I give the following table, the reading of which should be accompanied by a reference to a map of Queensland:—

Charleville.	Roma.	Dalby.	Toowoomba.	Brisbane.
S.E.	calm.	W., light.	W., moderate.	W., strong.
Cunnamulla.			Warwick.	
S.E.			S.W., fresh.	

Further enquiry resulted in finding these winds to be concurrent with, or subsequent to, gales on the southern coast of Australia, and accompanied by a rising barometer, *e.g.*:—

1878—June 10.—West wind, accompanied by rising barometer. In this case the rise was succeeded by a fall, the reading being very low at southern stations; severe weather to southward.

1878—June 14, 15.—West wind; rise in barometer.
,, June 20, 21.—West wind; rise in barometer.
,, July 5, 6, 7.—West-south-west wind; rise in barometer.
,, July 26 to 29.—West winds. Falling barometer on the 26th and 27th; rising barometer on the 28th and 29th.
,, August 18, 19, 20.—West wind; rising barometer.

In all these instances heavy weather—viz., gales of wind with rain—was prevalent at southern stations.

Supplied with this information, I venture to assert that (1st) the high westerly winds experienced here are the result of the weather experienced at stations to the *south;* (2nd) they are coast winds, and do not penetrate to or come from the interior; (3rd) as they originate in the south, and not in the west, their arrival can be predicted almost with certainty by reference to the weather reports from the southern colonies.

In support of the above assertions, and as a further illustration of the subject under consideration, I append the result of an attempt to follow the track of an inrush of polar wind on the Australian coast during the period from the 7th to the 12th of May this year. The accompanying chart shows that during the three previous days—viz., the 5th, 6th, and 7th—an area of high pressure passed slowly over Australia from Cape Borda, in South Australia, to Sydney, in New South Wales. On the 4th the maximum of pressure lay near Cape Borda, on the 5th near Wentworth, on the 6th still near Wentworth, with barometer rising; on the 7th the barometer was falling and the area of maximum pressure was near Sydney. This area resembled the "anti-cyclonic" areas of the Northern Hemisphere in its slowness of motion, the reverse motion of its winds, and in the light character of its winds. Mr. R. H. Scott, in "Weather Charts and Storm Warnings," defines anti-cyclonic systems thus:—"They are marked by a very slow circulation of the air—or in other words, by light winds—by low temperature in winter, great absolute dryness of the air, at least in the centre, and consequent absence of rain. . . . When we look at the winds we find that their circulation is exactly opposite to that of cyclonic systems—it is *with watch hands.** . . . If the barometer reading at any place or district is higher than at the places all round it, that place or district is the centre of an anti-cyclonic area."

During the 7th a gale from the south-west was advancing upon the Australian coasts, and by 9 a.m. on the 8th the barometric conditions were altered completely; the isobars which on the 7th circled around the district immediately to the north-west of Sydney, now ranged in nearly parallel lines from south-west to north-east, the area of lowest pressure being over the north-west coast of Tasmania. That this gale came from a true south-west direction is evident, for vessels coming from King George's Sound to Adelaide experienced no high winds.

The "Sepia," bound for Brisbane, in longitude 129° E., latitude 45° S., had variable winds on the morning of Friday, the 7th; about 2 p.m. the wind gradually freshened until it became a gale from the south-west; all Saturday it blew a steadily increasing gale (with rain), and on Sunday it blew a hurricane from west-by-south; the ship taking in water, the watch having to take to the rigging, and the "look-out" man to the fore-yard. On Monday the wind veered to south-west and moderated.

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* This, of course, is for the Northern Hemisphere; the reverse, or against watch hands, is the case in the Southern Hemisphere.

Shortly after sunset on Friday, May 7th, dark, heavy clouds rolling up from the south-west gave the first indication at Adelaide of the coming gale, which shortly afterwards burst over the city "with much fury," the barometer abruptly turning and rising. During the night the gale came round the coast and made its way inland. A vessel passing Cape Otway reported that the winds came round from south-south-west at 2·30 a.m. Saturday, 8th, at Melbourne, the gale commenced in the early morning,* with boisterous, showery weather; by 9 a.m. the wind and rain had reached inland as far as Mount Remarkable, at the head of Spencer's Gulf, South Australia, and to some of the Riverina stations. At this time, along the east coast of Australia, the wind was north as far as the Richmond River, and south-east from Rockhampton northward. By 1 p.m. the gale had reached Gabo Island, and at 5·40 was reported at Sydney, blowing very heavily and with a little rain; the velocity being, during the first hour, at the rate of fifty miles per hour. The gale reached Brisbane shortly after midnight, when a strong westerly wind sprang up. During Sunday, the 9th, the gale continued with unabated force, the subjoined stations reporting as follows:—

Adelaide—South-west, wet and squally.
Melbourne—South-west, accompanied with drenching showers of rain and hail.
Sydney—West, strong, with squalls, but sky clear and fine.
Brisbane—West, strong, but with cold clear weather.

During Sunday night the wind increased at Melbourne and Sydney, abating somewhat in violence at Melbourne about midnight, and at Sydney during the early morning of Monday, 10th. At Brisbane it continued to blow west fresh and boisterously all Monday. By Monday night the winds had veered to southerly, and on Tuesday, 11th, the weather gradually became fair. Its course eastwards can still be traced by the aid of the shipping reports in the daily papers. The s.s. "Albion" left the Bluff, New Zealand, for Melbourne on the evening of the 7th and met south-west gale on the 10th. The "Helena," Oamaru, N.Z., to Melbourne, passed Cape Farewell on 2nd May, and on the 11th encountered a gale from south-west which blew with hurricane violence and with a heavy sea, moderating on the 13th. The experience of the "John Knox," from Sydney to Lyttleton, New Zealand, was a peculiar one on the 12th—the barometer went down, the sky was overcast, a waterspout passed the vessel, and a heavy cross-sea arose, but with little or no wind; the report says that the weather had every appearance of a hurricane. The reports of many other vessels show that the gale crossed from Australia to New Zealand, which it reached on the night of the 12th, blowing a gale from south-west at Lyttleton, with heavy rain and fierce squalls.

The fact of a south-west gale having started from Australia had not escaped the vigilant observation of the Meteorological

* The barograph record shows a steady fall during 7th till midnight, when the barometer remained steady but low till 8 a.m. 8th. The cessation of the fall shows the arrival of the gale.

Department at Wellington, New Zealand, and forty-eight hours before its arrival the ports had been warned by the officers of the Department. For two days the gale blew on the New Zealand coast, and then probably either lost itself in the vast area of the South Pacific or dashed itself in fury on and around the Horn some days afterwards.

I have mentioned the circumstance of the wind blowing from the north along the east coast of Australia on Saturday morning, 8th. If the report of the s.s. "Southern Cross" can be accepted, a north-west wind was prevalent along the east coast of Tasmania all that day and until Sunday morning, 9th, although in the meantime a south-west gale had passed through Bass' Straits and reached Brisbane.

Queensland weather reports show that this gale *was not felt anywhere W. or N. of a line drawn through Roma, Tambo, and Cape Capricorn.*

From these reports we may legitimately conclude that the westerly winds experienced here on Sunday and Monday, 9th and 10th May, did not come to us from the region of "the setting sun," but was the polar wind which, striking the south coast of Australia on the night of the 7th, reached successively Cape Otway and the Victorian coast on the morning of the 8th, and Gabo Island and the New South Wales coast on the afternoon and evening of the same day.

The question as to whether all our westerly winds are polar or not is in nowise settled by this example. We shall in all probability have many more of them this winter, when, if their characteristics are carefully noticed and the weather noted over as large an area as possible, we may be able to speak more definitely. In this instance, however, we may conclude that although a westerly wind was blowing at Brisbane it was in reality a polar current; and for these reasons:—All stations in Queensland to north-west and west of the line alluded to above reported calm or wind south-east; the coldness of the wind indicated that it was the same current which caused the hail at Ballarat on Saturday, the 8th, and covered Mount Wellington and the Australian Alps with snow on Sunday and Monday, the 9th and 10th; its dryness being doubtless due to the general deposition of moisture on the south coasts of Australia and on inland districts to the south-west of us.

That it is possible to foretell the arrival here of these winds is plain, as previous to their arrival the barometer falls, and, coincidently with their arrival, stops its downward course, turns, and rises.

A weather chart of Australia, if published and distributed (which might be done daily by 2 p.m.), would, in this instance, have enabled us in Brisbane to presage the approach of this strong westerly wind nearly twelve hours before its arrival. (See plate 2.)

By Authority: James C. Beal, Government Printer, William street, Brisbane.

EXPLANATION OF PLATES.

PLATE I—Is intended to show the lines of equal pressure on the 5th, 6th, 7th, and 8th May, at 9 a.m., illustrating the remarks at page 2.

PLATE II.—Fig. 1.—Chart showing distribution, &c., of winds at 9 a.m. on Saturday, 8th May, 1880. Arrows fly with the wind.

Fig. 2.—Curves showing the fluctuations of the barometer at Melbourne, Sydney, and Brisbane.

Fig. 3.—Curves showing the fluctuations of the barometer at various stations in Western and South Australia, Victoria, Tasmania, New South Wales, Queensland, and New Zealand, during period 5th to 13th May, 1880.

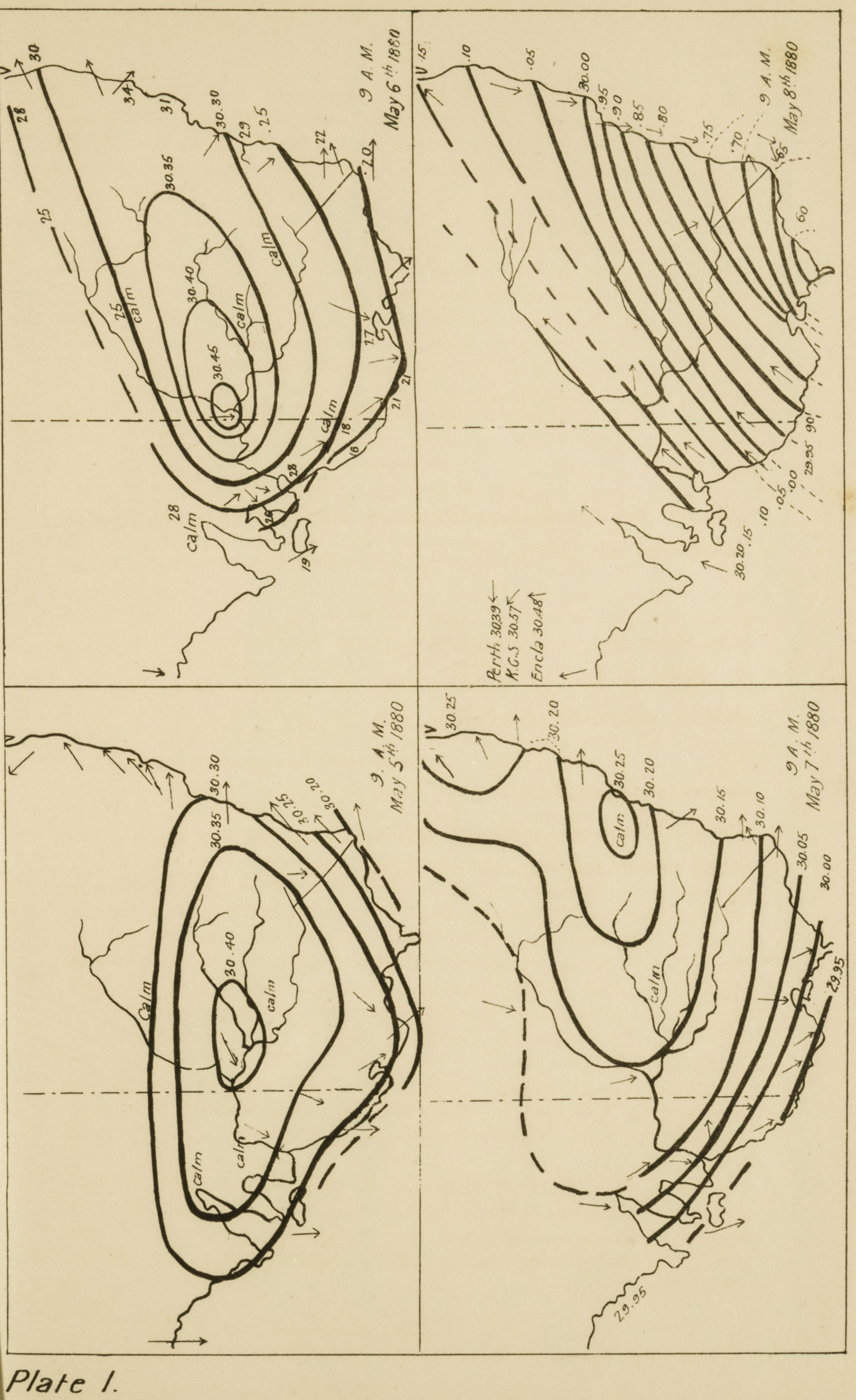
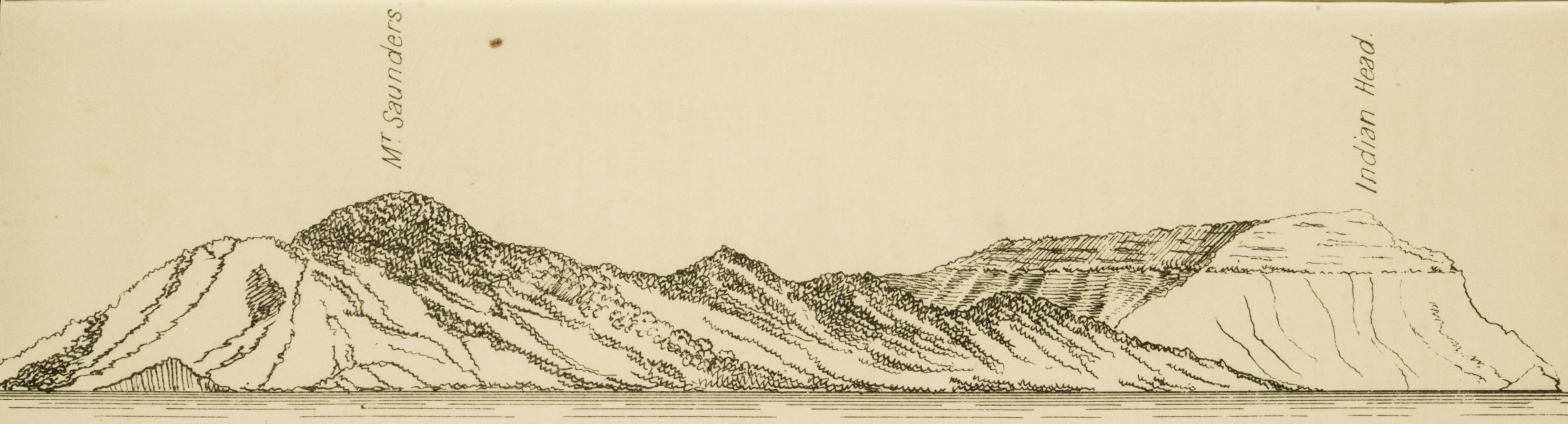
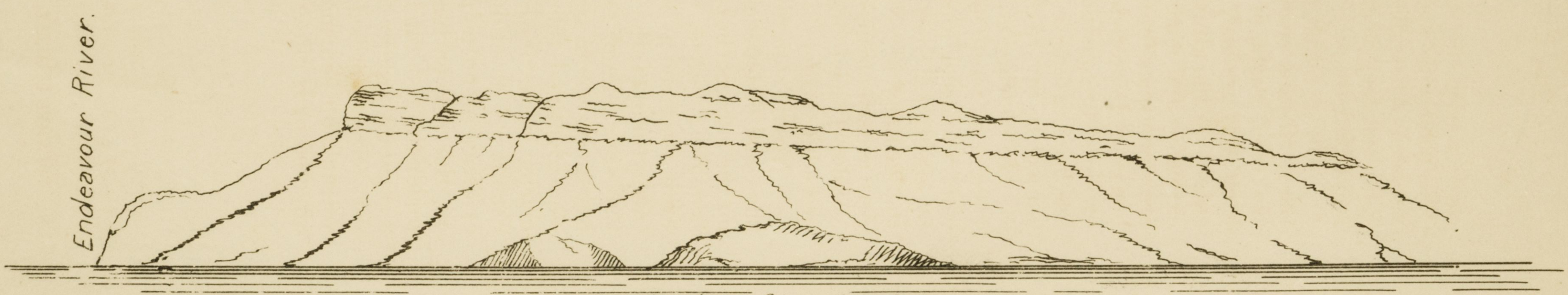

9 A.M. May 6th 1880
9 A.M. May 8th 1880
9. A.M. May 5th 1880
9 A.M. May 7th 1880
Perth 30.39
K.G.S 30.57
Encla 30.48

Plate I.

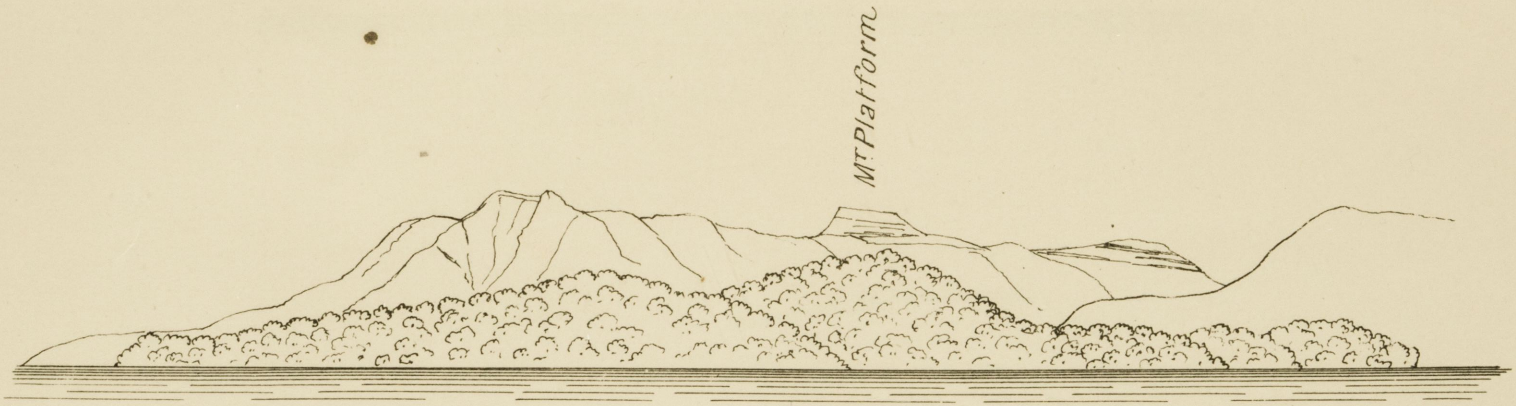


Outline Sketch No. 1.



Outline Sketch No. 2

Continuation of Dalrymple Range N. side of Endeavour River.



Outline Sketch No. 3.

Outline Sketch No. 4.
Connor's Nob

Sketch No. 5.

Rock near Cape Bedford.

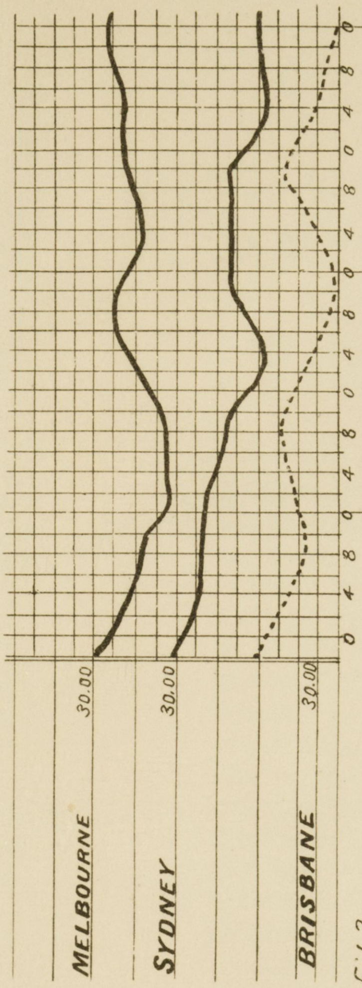


Fig 2

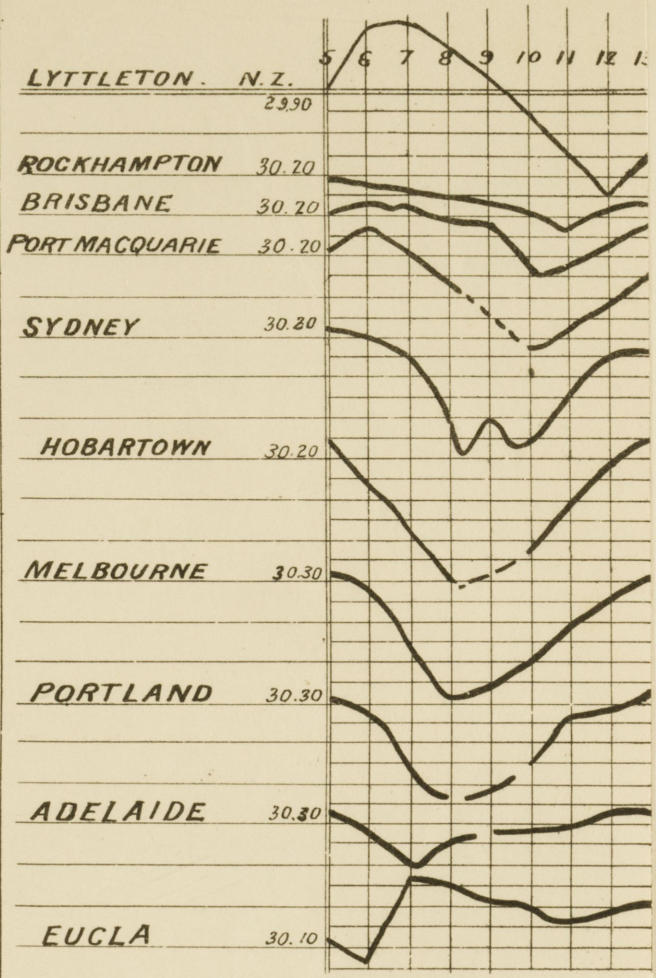


Fig 3

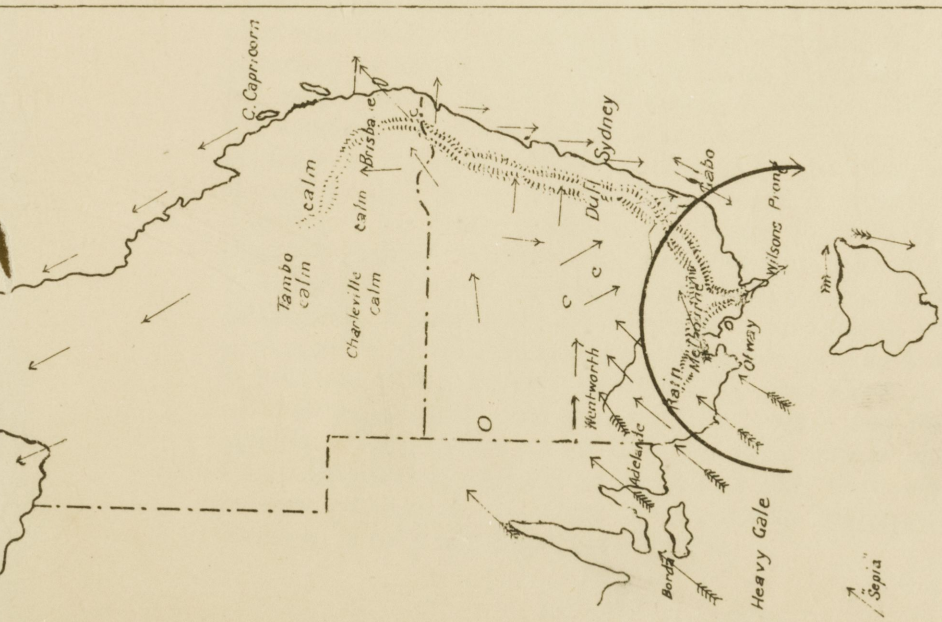


Fig 1.

GEOLOGY OF NORTHERN QUEENSLAND.

BY THE REV. J. E. TENISON-WOODS, F.L.S., F.G.S., Etc.

Read before the Queensland Philosophical Society,
20*th December*, 1880.

Although the geology of Northern Queensland has occupied the attention of many learned and eminent geologists, we know as yet very little about it. This arises from the fact that so much of the country remains unexplored. The first observer in the field appears to have been Dr. Fitton, who, in "The Appendix to King's Voyages," gave a list of the rocks collected during the survey. The list is of no value to us now, and gives very little indication of the nature of the strata met with. Many other observations were made by Stokes, Leichhardt, Mitchell, and others, which are not of much use to refer to. Mr. Jukes, in his essay on the physical structure of Australia, refers but slightly to Northern Queensland. The first systematic attempt known to me to give a geological map and description of Northern Queensland is that by Dr. A. Rattray, R.N. In "The Journal of the Geological Society for 1869," at page 297, there is a paper by that gentleman, entitled "Notes on the Geology of Cape York Peninsula." He gives much valuable and interesting information about the nature of the country between Princess Charlotte's Bay and Cape York. He also gives a sketch map dividing the rocks into igneous and tertiary, the latter being again divided into sandstone and ironstone. As much of the area was not then and is not even now explored, his map may be regarded as ideal only. The paper is an extension of one read before the Royal Society in September, 1865. With many of the conclusions arrived at geologists will not agree—such as the evidence of upheaval which he thought he observed, and with the statement that the whole of the east coast of Australia is slowly uprising. In other respects the paper contains facts of considerable value. I believe he was the first who noted that the culminating point of the Cape York Range is the Bellenden Ker Mountains, which attain an elevation of 5,158 feet, and decrease *pari passu* with the diminishing area of the land, as the peninsula is followed in a northerly direction. I shall show, in the course of this paper, that this generalisation must not be taken too strictly. The depression of the mountain axis is variable until Cape Bedford is passed, after which the decrease in height is very gradual up to Cape York, whose highest point, Cape Bremer, is only 400 feet above the sea.

In 1872 the late Mr. Daintree published his essay on the geology of Queensland in "The Proceedings of the Geological Society," page 271. In this paper the author purposely excluded the Cape York Peninsula—or, at least, all north of the Mitchell River—from his investigations, as the country was so little known. In his map, however, he sets down the south bank of the Mitchell River as occupied by his tertiary desert sandstone, and this is incorrect. The Mitchell flows partly through granite ranges, partly through slates and schists of paleozoic age, and partly at the base of hills which are capped by a sandstone which I regard as the equivalent of the Hawkesbury (Mesozoic?) sandstones of N. S. Wales.

In 1873 Mr. Elphinstone Dalrymple made an expedition along the coast as far as the Endeavour River, and in the same year Mr. Hahn explored the interior of the same territory. Both expeditions resulted in geological observations, but nothing very detailed. Mr. Hahn was accompanied by Mr. Taylor, a professional geologist, but his report has never been published.

I am not aware of any other account of the geology of this part of Australia. Mr. R. L. Jack has been appointed the Geological Surveyor for the Northern Districts since 1877, and from that time has been busily engaged in exploring the northern portions of the peninsula. He has already issued valuable reports on the geology and mineral resources of the district between Charters Towers Gold Field and the coast, besides papers specially devoted to the Bowen Coal Field and Charters Towers Gold Field, and will, no doubt, soon give us valuable information upon the whole geology of the district.

My knowledge of the country I am dealing with extends from Townsville up to Cape Flattery in latitude say 14° south, and inland as far as the Hodgkinson Gold Field and the Normanby River. I shall commence by describing the coast line, and then deal with the formations I have met with in the interior.

In coasting northwards from Rockhampton, an observer has an excellent opportunity of seeing a good deal of the rock formations. The coast is very bold and the number of islands so great, that all day long the steamers are within a cable's length of one or other of them. The islands are very evidently of three kinds:—1. Granite or trappean with a rugged surface and plenty of pine trees. (*Araucaria Cunninghami.*) 2. Flat-topped sandstone islands with apparently little vegetation; of these the Beverly group seem to be notable instances. 3. The trappean, such as Prudhoe Island and Percy Islands, with high peaks and a good deal of open grassy land. It must be remembered that I have not landed on any of these islands, and that my generalization is only made from a distant view. It is very probable also that in the large Percy Islands there may be a development of paleozoic rocks beside the trappean. All the salient points of the main land are granitic, and north of Cape Conway all the islands are granitic or coral islands. Sir James Smith's group appeared to be trappean from their outline, but I was never very close to them.

The passage between Whitsunday Island and the main land is rather narrow but the water is deep, and the land rises on each side in high granite jagged ridges of the most picturesque character. Cape Gloucester is a granite island which rises abruptly from the water into sharp pinnacles and ridges about 2,000 feet high. In the background is the heavy-looking dark mass of Mount Dryander, which is partly metamorphic and partly granitic and trappean, and over 3,000 feet high. All around Port Denison the view is diversified by many granitic peaks and mountains, whose summits are so stony and rugged that the bare granite rock is quite conspicuous, and but for the climate might be mistaken for a capping of snow. Cape Upstart on the north side of Port Denison is just such another abrupt mountain mass as Cape Gloucester, rising almost as a precipitous ridge out of the sea to about the same height, having a very sharp, rugged outline. Beyond this the granitic axis recedes from the coast, and the low-lying land is formed of alluvial flats, through which the Houghton and the Burdekin drain into the sea. Cape Bowling Green is almost level with the water's edge, and the water shoals so gradually that there can be no doubt that the alluvial deposits of the river must extend a long distance out to sea. The Burdekin drains an immense area. One of its main tributaries comes from the Bellenden Ker ranges, and another from the south as far as Peak Downs, Mitchell's Belyando River being its main channel. It is a stream with an immense bed. In the dry seasons there are three distinct channels, but in the rainy season the body of water which comes down it is enormous. The sea is quite muddy as far as the Barrier Reef, and sometimes little more than brackish. The current is also very strong from the river, and it is more than probable that it was by this current that the unfortunate Gothenburg steamer was in 1874 carried out of her course on to the Barrier Reef.

Beyond this low-lying land the granite ranges reappear in Cape Cleveland, which is a bold headland similar to all the other granitic capes. Cleveland Bay succeeds this with a high granite island lying outside it, named Magnetic Island. Mount Cudtheringa is a high granite peak in the midst of Cleveland Bay, but with the exception of some granite outliers, the country around it is flat, and rises very slowly towards the main divide. North of Cleveland Bay the same series of level country and granite outliers continue to Rockingham Bay, at the southern part of which the alluvial flats of the Herbert River are found. Above the mouth of the Herbert is Hinchinbrook Island, which is a narrow range of granitic and trappean mountains, some of which rise to over 3,000 feet above the sea. These mountains are so steep and rocky that they present only bare and precipitous faces of stone. It is only in the gullies that a dense tropical vegetation is seen, and this is of the richest description, with palm-trees predominating. Nothing can exceed the picturesque appearance of the sharp outlines of the mountains which form the islands; their bare slopes of rock and their proximity to the sea making them look less elevated than they really are. Some of the slopes of rock are quite black, exposing an immense surface of bare stone, without a trace of vegetation. These, I suppose, are trappean. Others, by their texture and colour, can be seen to be clearly granitic. Hinchinbrook channel, though wide, is very shallow, and there are long mangrove flats upon the main land. I looked very carefully for any signs of upheaval, but could see none. The channel may be filling up by the denudation from the mountains on each side. At Cardwell, which is situate on the north end of the channel, the beach and the shore are made up entirely of granitic debris. The waters of the sea are so muddy as to resemble a river rather than the ocean. The main range rises like an abrupt wall at a couple of miles distance from Cardwell, so that the creeks from the dividing range have only a very short course.

From Cardwell to Cairns, a distance of 70 miles, I had no good opportunity of seeing the coast. We know, however, that the range dividing reaches its greatest elevation in this interval in the Bellenden Ker Mountains. At a part of the coast called Morilyan Harbour, the Johnston River finds its outlet to the sea. My opportunities for observation on this place were very brief. A few granite hills of moderate elevation flanked the harbour, and the Main Range was approached by extensive river flats. All the islands of any elevation are granitic with a few coral islets interspersed.

Between Cairns and Port Douglas the land abuts upon the sea in lofty ranges which are densely clothed with forest. Here it is that the Dividing Range breasts the ocean, and it continues so with little interruption as far as the Endeavour River, a distance of nearly 100 miles. In this interval there are a few sandy beaches of moderate extent, but the great proportion of the coast is rocky and precipitous with forests of the most dense tropical vegetation crowning every ridge. The greater part of the mountains are over 3,000 ft. high, and for nearly all the year are clothed with cloud so that their outline can rarely be seen. Two peculiarities on the coast range are very conspicuous and picturesque. One is, that the Dividing Range is so precipitous and rocky near the sea that a large number of cascades can be seen falling over the cliffs. Another is a number of yellow strips of grassy land which seem to run to the top of the ridges. These are clothed with very luxuriant grass. I saw this from the facility with which they blazed up when lit by the natives as signal fires. I should imagine they must be due to some peculiarity of the soil, or perhaps they are too steep or rocky for trees to grow upon them. The line of gigantic forest timber on each side is as sharp as if it were cut with a knife.

In some of the recent maps of Queensland the Main Range is represented as lying a long way from the coast, and giving rise to important rivers with a direct east and west course. None of these facts are correct. The rivers, if they are important, flow nearly north and south along the valleys between outliers of the Main Range. Mount Thomas is a very important mountain of granite near Port Douglas; and Mount Peter Botte, 3,500 ft., is another granitic peak about 40 miles inland from Cape Tribulation which separates Trinity from Weary Bay. Mount Cook (1,400 ft.), at the mouth of the Endeavour, is another granite peak with many hills of the same kind of rock and lower elevation in the neighbourhood. Here and there cliffs of stratified rock may be noticed on the coast, and as far as I could discern at a distance the formation was closely similar to the paleozoic rocks of Victoria and New South Wales, the strata being inclined at high angles. At Island Point, Trinity Bay, the rock formation exposed was a paleozoic metamorphic rock, the strata still traceable and very highly inclined. Here and there a dark substance very like dolerite can be seen in the mass, but not confined to any particular stratum. It would be hard to give it a name from its external appearance, but I attributed it to partial metamorphism. There was no granite in the immediate neighbourhood.

About ten miles further north the Daintree River finds an outlet to the sea. I ascended this river as far as it is navigable, but was not able to find any rock sections except in one or two places. These were clay slates almost vertical. At a cascade about 20 miles from the mouth of the river the water falls over a rock like diabase.

In making a journey inland from Island Point as far as the Hodgkinson River, I found the rock formation to be highly inclined slates, schists, and sandstones, with quartz veins, until a granitic axis is reached, at about thirty-five miles from the sea. After this range has been passed over, lower paleozoic rocks succeed, with quartz veins and trap-dykes, in which the Hodgkinson River Diggings occur. I have dealt separately with the geology of the Hodgkinson Gold Field,* and shall return again to the consideration of the geology of the interior.

After passing Mount Cook at the mouth of the Endeavour River a notable change takes place in the geology of the coastline. The Endeavour River basin itself is an immense amphitheatre formed by the recession of the coast range in a large semi-circular curve inland. The range returns to the coast at a point called Indian Head,† of which an outline sketch is here given (see outline sketch No. 1). The granite has now disappeared, and instead we have paleozoic rocks highly inclined, curved, and folded in a series of anticlinal and synclinal folds, on the top of which rest strata of almost horizontal ferruginous sandstone, in appearance very like the Hawkesbury sandstones of Port Jackson. The hills on the coast range and in all the country back towards the head of the Endeavour River are of unequal height, showing in every part long-continued subaerial

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* See *Transactions of Royal Society of Victoria for* 1880.

† A name badly selected, as there is already a point named Indian Head on Frazer's Island, near Brisbane.

denudation. Wherever they rise above a certain elevation they are always capped by this horizontal sandstone, which itself has been very much denuded. Sometimes they lie in thick beds, as at the gap of the Endeavour River (see outline sketch No. 2) or at the Dalrymple Range. Again they occur as mere outliers at the top of a hill, as at Mount Platform (outline sketch No. 3), and Connor's Nob (sketch No. 4). The whole of the country is so modified by these sandstones as to give it a marked character; and as this formation must not only be extensive, but also bear a permanent geological character, I shall refer to it subsequently as the Dalrymple sandstones, after the range in which they are so well developed, and the explorer who first mapped so much of this region. They are found in certain places to contain fossils, I believe, of plant remains only, and these of a fragmentary character. What little could be made out concerning them is that they are similar in form, like the stone in which they are embedded, to the plant remains in the Hawkesbury sandstones. I do not pretend to settle the question at once of the identity of the two formations, though the similarity is very great; and for this reason I keep the names for the present distinct. Though the Dalrymple sandstones appear horizontal, yet when the formation is traced over large areas a gradual dip to the north-east may be observed. This observation was made to me first by Mr. Robert Jack, the Government Geologist, and it was confirmed by all that I saw. Mr. Jack has traced the formation as far north as near Princess Charlotte's Bay. It extends inland for a very considerable distance, but appearing only at intervals in small patches as outliers, or unconformably upon the upturned paleozoic slates, schists, and quartz reefs, with conglomerates between.

At Indian Head, the junction of the paleozoic rocks and Dalrymple sandstones is very plainly visible. They are quite unconformable to one another. The paleozoic rocks are curved and twisted; there is a thin seam of conglomerate at the junction, and then the sandstones ensue in horizontal strata. A little beyond Indian Head, there is a point of rock at the level of the sea of a most interesting character. It is the core of one of the folds of the paleozoic strata. Near its junction with the land the strata are almost vertical, but, as they are followed towards the sea, they gradually curve more and more until they become horizontal, as shown in the accompanying sketch, No. 5. Beyond this point the northern side of Indian Head shows the folds of the paleozoic strata very clearly.

The next point beyond Indian Head is Cape Bedford. It consists of a peninsula formed of two hills, one round topped, and the outer one flat on the summit. Both are capped with outliers of the Dalrymple sandstones lying upon the usual paleozoic strata.

To the north of Indian Head, and between it and Cape Bedford, there is a stretch of about eight or nine miles of sand hummocks. They are white and red, but the white sand predominates. The appearance at a distance is very like houses. There is no rock showing out, and the vegetation seems scanty and poor, with but few trees.

North of Cape Bedford is the inconspicuous opening of the McIvor River. This runs through open alluvial plains of the richest agricultural character. From the description I have heard of the country around the McIvor, I should imagine that the soil is derived from the decomposition of volcanic rocks, but I have not seen more of the locality than the mouth of the river, and that only at a distance. The sandy soil and sand hills continue, with some interruption, as far as Cape Flattery, where granite reappears. The Lizard Islands which lie off the same cape are entirely granitic. Beyond this, I know nothing of the peninsula from actual observation, but I am informed that the coast is very uninteresting. The Main Range continues to diminish in height as far as Cape York, where, as already stated, it is scarcely 300 feet high. I have been dealing thus far with the coast region only, and I now proceed to relate what little I know of the interior. Of the journey from Island Point to the Hodgkinson, I have already spoken. The gold diggings are situated on a branch of the Mitchell River, and the auriferous district extends at intervals from the Slate Range close to the Mitchell on the east to the Walsh River, which is one of the principal tributaries of the Mitchell. It may perhaps be necessary to state that the river last named is one of the main channels of drainage from the western side of the Dividing Range into the Gulf of Carpentaria. Its sources are not more than ten miles from the Pacific, which will show how very near to the sea the main divide is in the Cape York Peninsula. The river has a very large number of tributaries, the principal of which are Rifle Creek, the East and West Hodgkinson, the Walsh, and the Palmer. It has a very long course to the Gulf, probably more than 500 miles, and its sources may be said to be the main granitic axis of the divide and the slaty auriferous hills which are found by the side of the granitic axis, and often exceeding it in height. From the fact that some of the longest and best tributaries come from the east, we may conclude that the main sources of the river are amongst the heights behind Trinity Bay, from Mount Harris to the Endeavour River. The Lynd is another of its tributaries, and by far the most important of all. This has its sources in the Bellenden Ker Ranges, whose highest summits are, as I have already stated, to the north of Cardwell. The great mass of mountains are granitic, but to the westward the slopes are occupied by a mass of ranges which are Silurian probably, or at least upturned slates of paleozoic rock with quartz veins and trap dykes. The dykes are numerous and trappean. They have been so altered by metamorphism that it would be difficult to give them a name from their external character alone. They are now porphyritic, and enclose large crystals of what seems like hornblende, but of such large size that the stone might easily be mistaken for a conglomerate. On the eastern side of the table land, the upturned edges of the slate seemed like a dolerite, and I should think newer than Silurian, because of its resemblance to upper paleozoic rocks in other parts of the colony. But my conclusions on this subject were formed from a very slight observation.

In connection with the slates, dykes, and quartz veins of the Hodgkinson Gold Field there was a considerable outcrop of black limestone, besides very thick veins of quartz which include no gold. Some of the hills also were of strata consisting largely of jasper and chalcedony; the strike of all the quartz veins is east and west, but the strike of the slates is a point east and west of north-east and south-west, so that the slates abut diagonally on the faces of the reefs. The dykes correspond in strike with the strata, and as they are more recent they continually cut off the veins and fault them. The course of the ranges about the diggings is the same as the strata, and this is very nearly diagonally to the main divide. From the direction of the streams we can gather that this is generally the course of the spurs which flank the granitic axis.

There can be no doubt that the granite is the transmuted lower paleozoic strata. This can be seen as the road crosses the axis. Slates gradually pass into schists and so on into gneiss and finally granite. In saying that these rocks are Silurian, I only do so from the fact that they are very similar in character to the lower Silurian auriferous rocks in Victoria, which are known to be so from the included fossils. Those of the Hodgkinson may be either older or younger.

We can conclude nothing as to the extent of the beds transmuted into granite from the thickness of the granitic axis, because it is most probable that these upturned strata represent a series of folds whose curves have been denuded away. Sometimes in the midst of the granite little patches of unaltered, or very slightly altered, slate may be seen. They have generally the same dip and inclination as the other parts, as well as the gneiss and schist, from which we may conclude that the slates were upturned to their present angle, or, rather, that the folding of the strata was effected before the metamorphism into granite.

In the midst of these ranges we find an isolated patch of the Dalrymple sandstone, lying unconformably upon the summit of the slates just as before described at the mouth of the Endeavour River. This is Mount Mulligan, an isolated range of about twelve miles in length and very conspicuous amongst the neighbouring hills for its flat-topped summit and precipitous outline. The lower part of the mountain, as it consists of slates and quartz reefs, is worked for gold, and there are mines on several different portions of it. There cannot be much doubt that all the ranges hereabouts were at one time covered by this deposit, which probably stretched over the whole peninsula; but it has all been denuded away, leaving only a few outliers on the summits of the ranges. The section of

Dalrymple sandstones on Mount Mulligan is a more extensive one than on any other mountain in the north of Queensland. The appearance is exactly that of the sandstone on the Blue Mountains or at Port Jackson. It is a fine-grained freestone, with many ferruginous concretions and red bands. It is full of strata of the nature known as false bedding. I am not aware that fossils have been found in it, but I am assured that the quartz veins never penetrate it, nor is it known to have any volcanic dykes.

I return now to the Endeavour River, from the mouth of which I made an excursion inland. The line followed by me is about 100 miles north of Mount Mulligan. The town of Cooktown is built entirely on the grey and pink granite of Grassy Hill, except the small portion already mentioned, which is occupied by a doleritic dyke. About two miles out of the town the granite ceases, and there are many outcrops of vertical slates and schists with quartz veins. As well as I could ascertain, this formation continues for a considerable distance inland, say 14 or 15 miles, but of this I can hardly be sure. The ground is level and extensively covered with an alluvial deposit. There are very many creeks or small rivers, but though they have not deep channels I saw nothing but alluvial deposits on the banks. The first mountain range crossed was about 1,000 feet above the sea. The rock was somewhat similar to the slates on the lower ground, but belongs to a different formation. It is a highly-inclined quartzose sandstone, the beds dipping at various angles, sometimes quite vertical, and sometimes curved and contorted. I have been informed by Mr. Jack that plant impressions are found on these rocks, and that they are quite similar to the coal-bearing deposits to be mentioned presently.

After passing this range—called, I believe, the Annie Laurie—another range is crossed at about 1,400 feet, evidently of the same character. This is, I believe, known as the Grecian Bend. The hills after this become extremely steep, and the country of a very broken character. The ground becomes covered with a peculiar gravel of rounded quartz ranging in size from a mere pebble to that of a man's head. I turned northwards from the road into the ranges for the purpose of examining a prospecting shaft which was being sunk in the neighbourhood for coal. Our course was along a creek, the banks of which were formed of the pebbles already mentioned, together with a conglomerate of other rocks, waterworn, and so much changed by the action of aqueous decomposition that it would be hard to say what was the original character of the strata from which they were derived. The creek soon became too much hemmed in by the hills for riding or driving, so we crossed a very steep slippery range on foot. I cannot describe the way in which the hill was thickly strewn with rounded pebbles of quartz. It was literally white with them. We reached the creek at another portion of its course, and found its bank lined with a series of low ridges of ferruginous shale or sandstone dipping away at about an angle of 35°. There were outcrops of a kind of coal on the banks, and on one of these a shaft was sunk to a depth of about 20 feet. There was a seam of anthracite exposed about 20 inches thick. In appearance, colour, lustre, &c., it was as good coal as any from Newcastle. It was, however, of a quality that would not burn unless a great heat were employed, and then only with a dull slow kind of combustion, leaving a thick white ash behind, or sometimes scarcely changing by the application of heat. It seemed to me very like the coal in the neighbourhood of Port Denison, where the seams are known to be "coked" by sheets of lava which overlie them. I could not see any evidence of igneous rocks in this neighbourhood. Yet, considering the broken character of the country and the inclination of the beds, I think that there must be considerable disturbance of a volcanic character, evidence of which will be forthcoming when a more detailed survey of the ground is made.

I made a further excursion to the north from this place next day towards two hills called The Brothers, on the spurs of which I was informed there were considerable outcrops of coal. I found the ridges of a very steep character, and outcrops of rock showing the nature of the formation clearly. The strata were composed of a coarse conglomerate of waterworn quartz pebbles of almost every size, cemented together by a hard, dark-brown, ferruginous paste, or concreted by a siliceous infiltration. Those who have visited the Upper Hunter River will not require to have it described. It is precisely similar in character to the rocks which form such conspicuous escarpments around Murrurundi and at the base of the Liverpool Ranges. These thick beds of pebbly conglomerate form the base of the coal measures. They are entirely composed of waterworn quartz pebbles or fragments of different kinds of trap rocks. Their actual thickness is not known, but the beds of the conglomerate retain their character in cliffs of several hundred feet. The relations of this formation at the Hunter River are not very well known—that is to say, whether it rests conformably or not upon any older formation, or what that formation may be. There, however, we may believe that it rests on older—much older—paleozoic rocks. The pebbles may have been derived from the denudation of these strata, or some of the missing links between them and the carboniferous and the quartz pebbles from the quartz reefs. This is only conjecture, but the strata at the Normanby River and those at the Hunter may be considered as belonging to the same formation. It is a remarkable circumstance that such peculiar features as this conglomerate presents should be the same at places 1,500 miles apart. One would think that such an accumulation of pebbles was dependent upon circumstances purely local, and it is not easy to understand how such deep and apparently such wide-spread deposits could be formed.

I followed up the course of these strata to the summit of a very steep ridge, along which the carboniferous conglomerates crop out at every few yards. Descending into a narrow gully or watercourse, a very good section of the beds was obtained. They dipped away at a high angle underneath the neighbouring hill. As I ascended the creek, many outcrops of dark carbonaceous shale were exposed in seams of about one foot to twenty inches thick. The shale was not near so promising in appearance as that on the creek visited the previous day, which was about three miles distant. I should think, however, that the locality should be well tested for coal seams. The lower coal measures of the Hunter River are known to have rich seams, and they are highly inclined like the strata near Cooktown, which, for convenience, I shall distinguish as the Normanby shales.

The ranges of hills in the neighbourhood were capped by the horizontal Dalrymple sandstones. I could not say what the underlying rock is, but Mr. Jack is of opinion that there is in this neighbourhood a line of fault. I am quoting from memory, but I believe he considered that the fault was at the foot of the ranges, and that the Normanby shales abut on the Dalrymple sandstones.

The creek on which the outcrop of carboniferous shales is seen forms a series of cascades and rock basins. This place being in the centre of a fierce and numerous tribe of natives, and our position on the rock basins being so very assailable, we were not able to give them a lengthened examination, especially as we were obliged to leave our horses tied to trees at the edge of the gully. It seemed to me, however, as if the rocks were not so full of conglomerate near the shales.

The Maytown or Palmer River diggings are about 80 miles from this locality. I had not an opportunity of visiting them, but I received a geological map of the district from Mr. Selheim, the Mining Warden, who is a geologist and a very intelligent observer. In this map he lays down areas of vertical slates, carboniferous sandstones and shales, with outcrops of granite and trap. As the outlines are only approximate, it would be of little service to give them. He says in his letter to me, "I have no data to fix the extent of the slates to the northward, as they dip under the plains of the Laura, and I have not met with any sections. However, there can be little doubt that they are succeeded by the carboniferous sandstones and slates found by Mr. Jack at Deep Creek. There are no granites between the Normanby and the Palmer. Those we have on the latter field are evidently part of the series traversed by you on your journey to the Hodgkinson. They are certainly metamorphic, but there is no visible transition from slate to granite. Their boundaries are defined with great precision, as, for instance, at Granite Creek, where the east bank is granitic and the west bank slate. Hence the creek is mined for both gold and tin. These granites are conspicuous for large crystals of orthoclase felspar some two inches long. I forward herewith also a sketch of Mount Mulligan, as I saw it on my way through the bush from the Palmer. I examined it on the line of the dip, and had a good opportunity of studying the bedding. I had no clinometer with me at the time—in fact, I was too hungry to lose much time; but I am sure that the conglomerates rest unconformably on the almost vertical slates. The chocolate coloured sandstones of the upper bed in their turn lie unconformably on the conglomerates. Mr. Jack is at present engaged in a geological survey of the Hodgkinson, and will doubtless bear me out should he view the mountain from the northward. The metamorphic schists of the Lower Palmer belong evidently to the same horizon as the slates and merge into one another. Referring to your question more particularly as to the axis of the Dividing Range, I have to say that, as far as I have seen, it consists of highly contorted slates and is unconformably overlaid by horizontal sandstones, on which no fossils have been found hitherto, but which doubtless are tertiary. The same series can be traced both by outliers and large ranges from the Palmer by the Gilbert and the Cloncurry to Port Darwin."

These sandstones here referred to are probably the same as the Dalrymple sandstones. They are in that case not tertiary but mesozoic. Any one who would examine the extent and structure of the stone, as well as the way in which it has been denuded, would scarcely fail to see that it is a much older formation than tertiary. The plant remains found in them resemble those of the Hawkesbury sandstones, as I was informed by Mr. Jack, though I have since heard, indirectly, that fossils of a cretaceous aspect have been discovered in them by the same geologist.

General Conclusions.—Though the foregoing observations are limited, from the scattered nature and the absence of any details, yet they are quite sufficient to enable us to make a summary of the geology of Cape York Peninsula. We have fortunately for our guidance in this matter the observations of Mr. Daintree on the rest of the colony, and it will be seen that there is a great similarity between all the localities. In fact we may say that on the eastern Dividing Range, from north to south, there is little or no variation in the geology. This may be summarized as a granitic or metamorphic axis with paleozoic formations on each side, ranging from Silurian to carboniferous, the whole capped by a horizontal sandstone or intrusive beds derived from ancient dykes, or tertiary basalts. There are no tertiary marine formations of any kind known on the whole extent of the range. This is true of every portion hitherto described, and I have now to add that the Cape York Peninsula forms no exception to this. For the sake of comparison, I shall now give Mr. Daintree's observations. He divides the whole of North Queensland, as far as Townsville, into a few distinct formations, thus:—Aqueous, including recent alluvial, containing extinct faunas; desert sandstone, which he calls cainozoic; mesozoic, including cretaceous, oolitic, and carbonaceous; paleozoic, including Carboniferous, Devonian, and Silurian, and Metamorphic. Of the alluvial, he says (see Proceedings or Quarterly Journal of Geological Society for 1872, p. 278) :—Fluviatile or freshwater deposits skirt all the present watercourses, but the accumulations are insignificant on the eastern watershed, except near the embouchures of large rivers, such as the Burdekin, Fitzroy, &c. On the shores of Carpentaria, however, and in the *south-western* portions of the colony, where the watercourses have scarcely any fall, and where in seasons of excessive rain the country is nearly all inundated, fluviatile deposits are very extensive. Although the sediments redeposited as alluvia between the Main Dividing Range and the *east* coast are as stated comparatively insignificant, they represent the denudation of no insignificant amount of varied rock material, since the present physical contour of the eastern portion of the colony is probably due to the influence of meteoric action, such as rain, &c. Though the dense lavas of the Upper Burdekin (volcanic outbursts of a late tertiary epoch) are traversed by valleys of erosion, in some cases 200 feet deep and five miles broad, yet very narrow and shallow alluvial deposits skirt the immediate margin of the watercourses draining such valleys. The same conditions are met with in all the more elevated table-lands or ridges, which give a character to the present physical outline of the eastern Main Range. It is only near the mouths of the larger rivers that any extent of alluvium has been deposited, and even these areas are at the present time in seasons of excessive rain liable to inundation, showing that little upheaval of this portion of Australia has taken place since the last volcanic disturbances terminated."

Mr. Daintree goes on to say that meteoric conditions were the same as the present time with regard to the distribution of the rain in the seasons ; but this, I think, is an assertion which we are hardly in a position to prove, though there is no evidence to the contrary.

As far as my observations have gone, the low-lying flats north of Townsville are of recent alluvial formation and are of freshwater origin. If they had been marine, we should expect to see signs of upheaval on these and other portions of the coast. There are, however, no such signs. This, I am aware, is a direct contradiction to the opinion of Dr. Rattray, already cited. But that gentleman cites no evidence of upheaval, such as raised beaches and marine fossils. He also appears to have been imperfectly acquainted with the coast geology of New South Wales, for he refers to that region as also affording evidences of upheaval, whereas such things are quite unknown. In fact, there could not be a stronger contrast than is presented by the whole of the north-eastern or eastern coast to the southern, where upheaval is either now going on or has been going on until recently. There the appearances are unmistakeable. From the mouth of the Murray River to Cape Bridgewater we have raised beaches and thick beds of fossiliferous rocks full of marine remains. The most of these are extinct, but above them for sixteen or twenty miles inland there is underneath the surface soil a thick deposit of marine shells. They are of recent appearance, some preserving their colouring matter. I have examined many of these beds and thousands of the shells from them, and I have found them all similar to the shells at present existing on the coast and not one extinct species amongst them. All scientific men will appreciate this when I mention the names of the commonest forms. They are *Venus aphrodina* or *scalarina*, *Bulla australis*, *Cerithium granarium*, *Turbo undulatus*, *Phasianella tritonis*, *Nerita atrata*, *Trochocochlea constricta*, *T. australis*, *Carinidea aurea*, *Clanculus undatus*, *C. nodoliratus*, *Euchelus badius*, *Thalotia conica*, *Bankivia varians*, *Patella tramaserica*, *Haliotis nævosa*, *Mactra rufescens*, *Anapa triquetrum*, *Tellina deltoidiales*, *Tellina albinella*, *Mesodesma erycina*, *Rupellaria crenata*, *Mytilus latus*, *Ampularina fragilis*, etc., etc., etc. All these are the common littoral shells of South Australia. If there be any difference it is in this, that the fossils are of larger size than those common on the coast. From this I concluded, at one time, that the climate of the later pliocene period was warmer. On the west coast of Australia there is a recent upheaval of land. Recent shells of the pliocene period were sent to me from a limestone quarry at Freemantle. These fossils included many which, as far as I know, are only found living in the tropics.

Besides the occurrence of recent shells in large beds at a considerable distance from the sea and at heights very much above the present sea level, the general aspect of the land is such as to suggest recent upheaval of a slow kind. The shore is low-lying and flat. Outliers of eolian rocks are found with traces of marine action upon them. There are immense sandy beaches and sand dunes along the coast, with large salt lagoons and marshes extending to some considerable distance within the land. These salt lakes are surrounded with beds of marine shells, and it is quite evident that some of the mollusca lived and died there long after the lagoon was separated from the sea, though there are none living in them now.

All these appearances differ in every way from what is observed upon the north-east coast. The land abuts on the sea for the most part abruptly. There is not the faintest sign of any upheaval in the form of raised beaches or any marine remains within the margin of the present known beach. Wherever the land is low-lying and flat it is covered with alluvial deposits either derived from the rivers or from ordinary weathering. A very large part of the coast line is, as I have already said, abrupt, and does not even offer a narrow beach of sand between the ocean and the steep acclivities of the ranges which rise above the waves. Besides this, the whole contour of the coast line is such as to suggest subsidence instead of upheaval. If we were suddenly to plunge any part of the Dividing Range some 500 feet below the present level, what would be the result? Why, the Main Range would rise abruptly out of the sea, while many of the spurs, ridges, and isolated peaks would appear as chains of islands, and very abrupt islands separated from the main by narrow and deep channels. The peaks and higher mountains would be small precipitous islands, and there would be groups of them where a cluster of hills formerly existed. Now, this, in brief, is a precise description of the north-eastern coast. The islands are just as described—ridges and spurs from the Main Range, which were formerly its precipitous peaks and crests, the deep valleys now represented by ocean channels of bold water.

If we examine the nature of the rocks we shall find the evidence still stronger. The rocks are those of the Main Range in every particular. Granite is the most abundant, as it is more common in the northern islands than in the south. The nearer the islands are to the shore the more granitic they are, while the outliers are often composed of highly-inclined metamorphic schists and slates. There are exceptions to this, however; just as we find on the Main Range the granitic or metamorphic portions as much exposed on the coast as in the centre of the axis. Finally, if we take a glance at the whole aspect of the north-eastern coast line we shall be forcibly struck by its resemblance to a range of mountains round which the sea has arisen. Any one who has witnessed the effect of a high tide on a very rocky coast, especially in places where the rise and fall is considerable (Jersey, for instance) will be struck by the resemblance it presents to the island coast line of north-east Australia.

From this, therefore, we may conclude that the coast range of Northern Australia, or the northern portion at least of the great divide, was formerly much higher than it is now. What the amount of subsidence has been, there is not knowledge enough of its character to form an opinion. There is no part of the channel between the main land and the Barrier Reef which is over 200 feet deep. An upheaval to this extent would lay bare dry land between all the islands and the main, as far as the Barrier. To raise all the reef itself, an elevation of 2,000 feet would at least be required, and probably even more. On the other hand, a subsidence of 3,000 feet or more would be required to submerge all the islands. Mount Stafforth and other mountains on Hinchinbrook Island are over 3,000 feet high, Cape Gloucester, 2,000, &c. Such a subsidence would submerge the whole of the Dividing Range, with the exception of a few mountains, such as the Bellenden Ker Range, Mount Peter Botte, and a few others. If the subsidence has been equal, and the depth of the Barrier Reef be any indication of its extent, then the Dividing Range must have been over 7,000 feet high in some places, and we might expect to find in extremely high portions of the range some evidence of glacier action. The river channels may also be expected to furnish evidence of their greater elevation. The large proportion of Asiatic species of plants in the flora of the northern divide certainly points to some more intimate connection with the Asiatic continent than that which exists now. It is useless to speculate on the connection that would ensue between Australia and Asia by an upheaval of three or four thousand feet, because we cannot be sure it would be general and extensive.

The question now meets us as to whether the subsidence of the north-east coast was sudden or gradual. The evidence of the coral reefs, if Mr. Darwin's theory be true, is that it has been very gradual, and this is to some extent confirmed by the extent of the alluvium on the plains. The accumulations are extensive and must have taken some long time to form. They are sometimes found to include extinct animal remains, such as bones of Diprotodon. But the country is too little known and explored to conclude much more with certainty than that there has been extensive denudation, so I must leave this part of the subject to future enquiries.

In conclusion, I must ask my readers to bear in mind that I claim no more correctness for these cursory observations than what a hurried journey through a new country would enable me to effect. A very different kind of survey must be made ere the geology of North Queensland can be thoroughly known. Any conscientiously recorded facts must be of value, and this is why I have lost no time in recording what I saw in the preceding pages.

Note.—Quite recently an impression has been current that the coast of Queensland is rising. A good deal has been written on the subject, but not one well-recorded observation has been brought forward. On several occasions I have gone to what were described as raised beaches, but they had no resemblance to anything of the kind. A Mr. Chas. Devis stated publicly that sea shells of existing species had been found on the Barcoo, but in answer to my questions as to where they were found and who identified them I have received no information. By the marine surveyors I have been informed that there has been no change of level in the last thirty years. I have found some evidence of outpouring of lava at Cleveland during recent times on the sea bottom, and fossils of existing species are found under the lava mud. This, however, must form the subject of a separate paper. I have no doubt that there has been some very circumscribed local upheavals in connection with these volcanic outpourings, but we have no evidence so far that it has affected or is affecting the whole Queensland coast.

James C. Beal, Government Printer, William street, Brisbane.

A FEW REMARKS

ON

OUR NATURALIZED SOLANUMS.

(*Read before the Queensland Philosophical Society by F. M. Bailey, F.L.S., Cor. M. R.S., Tas.; R.S., Vic.; L.S., N. S. Wales, on* 17*th March*, 1881.)

I am induced to bring under your notice the following short descriptive notes on some of the naturalized or supposed naturalized Solanums found near our towns, to assist in their identification in the event of some of our medical men investigating their properties. We know the fruit of some said to be poisonous in Europe is eaten by the children of this colony with impunity at times, while at other times the effect has been direful.

Dr. Bancroft tells me that in a few experiments which he has made with some of the naturalized species here mentioned, their properties vary considerably. Of the large genus Solanum over one thousand have been described, 700 of which are considered well marked distinct species; these, although most abundant in America, are found scattered throughout the warmer and temperate regions of the globe. The Australian species number about 50, forty-three of which are perhaps endemic. With regard to stature, the Australian species, as those of other countries, vary considerably, some forming quite small trees, others again attaining but the height of a few inches. The first to notice is the common garden and scrub weed,—

Solanum nigrum, *Linn.* The black-fruited Nightshade, or, as it is more frequently called by Brisbane children, Native Currant. There are two very distinct forms of this species. The one which may be called the normal form is of annual duration, branching somewhat erect two, three, or more feet high, but slightly hairy, and the stems more or less rough, with raised somewhat toothed angles. The leaves are ovate in outlines, and often irregularly toothed, 1 to 3 inches long, petioles usually long. Flowers, small, white, in lateral cymes, on a common peduncle of about 1 inch long. Calyx, five-toothed. Corolla, deeply lobed 3 or 4 lines diameter. Anthers, obtuse, the terminal slits often continued down the sides. Berry, small, black, globular, the calyx reflexed under the fruit.

There is a form very abundant about Brisbane of a procumbent habit, known to botanists as *S.* nigrum, var. humile. The foliage of this will be found clothed with glandular hairs; the leaves are also more prominently angularly toothed; the flowers are frequently found striped with purple; the calyx also will be found appressed to the fruit, which latter is of a greenish yellow when ripe. It is pretty generally allowed that the fruit of this form is unwholesome, yet the herbage of this and other forms of *S.* nigrum in the islands of Mauritius and Bourbon is highly prized as a culinary vegetable, similar to the spinach of Europe. I remember in the year 1852, during the rush of people to the Victorian goldfields, that persons coming from the Mauritius often brought seed of this plant to grow for vegetables about their camp.

Solanum auriculatum, *Ait.* This large auricled leaved species forms a small tree, and from its rapid growth has often been planted in Australian gardens where a quick shade has been required. The tree produces an enormous quantity of fruit, the poisonous or non-poisonous properties of which have not been ascertained. The species is found in the islands of Madagascar, Mauritius, and Bourbon; the whole plant is densely clothed with a yellowish white, stellate down. Leaves ovate, lanceolate, 1 foot or more long, and 3 to 5 inches broad; petioles, 2 or 3 inches long, with a pair of semicircular stipule-like leaves at the base. Flowers, purplish, borne in large pedunculate, dichotomous cymes. Berries, yellowish, globose, $\frac{1}{2}$ to $\frac{3}{4}$ inch diameter.

Solanum pseudo capsicum, *Linn.* The capsicum-like Solanum, which is frequently cultivated in gardens on account of the beauty of its cherry-like fruit, has also escaped and become naturalized in many places in Queensland. This species forms an erect branching shrub of 3 or 4 feet, has lanceolate, somewhat wavy, glabrous leaves, 2 or 3 inches long, tapering towards the base. Pedicels lateral, two or three together, or on a very short peduncle. Flowers, white, star-like. Berries, globose, reddish, from $\frac{1}{2}$ inch to 1 inch diameter. This pretty species is supposed to belong to Madeira. In European gardens it is known as Winter-cherry.

The above four kinds are unarmed, but besides these there are several kinds become naturalized, which are more or less furnished with prickles, viz.:—

Solanum pyracanthum, *Lam.*, or the Fire-spined Nightshade. This is a very handsome species. In a wild state, of rather straggling habit; but in the garden can be kept close, and then forms an attractive object, from the profusion of its flowers and bright colour of the prickles. When growing freely it forms a shrub several feet in height, having all parts prickly. Leaves, oblong, pinnatifid with narrow lobes, midrib reddish like the prickles. Flowers, violet, rather large, having a pale centre. Berry, globose. A Madagascar plant. This species was introduced some years ago as an ornamental plant by the Queensland Acclimatisation Society, from whose grounds it has spread into the pasture.

Solanum sodomæum, *Linn.*, or Apple of Sodom, has become widely diffused throughout the southern portions of the colony. This South African or Mediterranean species seems to have been introduced many years ago into New South Wales. It forms a rather rambling shrub of from 3 feet to 5 feet high, branches prickly, leaves dark green clothed with short stellate hairs and prickles, deeply lobed, on short petioles. Flowers, violet, in short irregular racemes; calyx, prickly; lobes, obtuse. Corolla, large, deeply divided, anthers thick. Fruit, 1 inch or more diameter, variegated with green, yellow, and white, having a green pulp between the outer rind and the seeds.

Solanum aculeatissimum, *Jaquin.* This is often found growing with the last species, but is a shorter plant seldom attaining more than 3 feet in height. Leaves, deeply pinnatifid, with broad lobes or nearly entire (repand), the larger nerves with stout prickles and rather long simple hairs, which are also found on the edge of the leaves and gives to them a ciliated appearance; leaves, about 3 inches long on petioles of equal length. Flowers, solitary or in pairs, white, peduncles about 1 inch long; calyx, prickly and glossy; lobes, somewhat acute. Corolla divided to about the middle into narrow lobes; anthers broad, of a bright yellow at the base, tapering upwards and becoming of a much lighter colour, filaments short. Fruit, a rich scarlet berry, inside of rind pure white, of a dry consistency, placentas small. Seeds, very flat and beautifully reticulate, of a golden colour, and surrounded by a thin wing.

Solanum aculeastrum, *Dunal.* This is a very large prickly shrub which, some years ago, was introduced for the purpose of hedge making, under the name of "Wait-a-bit thorn." That it has taken kindly to both soil and climate may be assumed by its being met with in places covering acres of land, with shrubs of from 6 to 9 feet in height. The whole plant is armed with stout straight or curved prickles and stellate hairs, and the young branches and underside of leaves white, with a short, white, close, tomentum. Leaves, 3 to 5 inches long, repand or more or less deeply lobed. Flowers, solitary or a few on a short peduncle. Calyx with or without prickles, the lobes obtuse with a short apiculate point; small at the time of flowering, but enlarging under the fruit. Corolla, white, tomentose with stellate hairs; lobes divided to the base, acute, in most flowers. Anthers, bright yellow. Fruit, large, globose, 1 to 2 inches diameter, glossy, more or less sprinkled with short conical prickles. Rind, hard, thick, yellowish when ripe, seeds embedded in a green pulp in the fresh fruit. The plant belongs to South Africa.

Other plants of the Order Solaneæ which have become naturalized in Queensland are, viz.:—

Nicandra physalodes, *Gœrtn.* This is an annual plant attaining the height of 5 or 6 feet. The fruit is a dry berry, enclosed in an inflated calyx similar to the Physalis, and is a native of Peru.

Physalis peruviana, *Linn.*, the common Cape Gooseberry.

Lycium chinense, *Mill.* The Box-thorn.

Datura stramonium, *Linn.* Thorn Apple.

Capsicum frutescens. The Shrubby Capsicum which bears erect fruit.

Lycopersicum esculentum, *Mill.* The Love Apple or Tomato.

Nicotiana glauca, *Graham.* The tree or glaucous Tobacco. This plant, which is a native of Buenos Ayres, has become naturalized about Ipswich, where it forms a large shrub with cordato-ovate, somewhat fleshy leaves, often more than 5 inches long by 3 broad. Panicles of flowers terminal. Flowers, tubular, of a greenish yellow colour, over an inch long.

Nicotiana Tabacum, *Linn.* The common tobacco plant is also found naturalized in a few places near where the plant has been cultivated.

James C. Beal, Government Printer, William street, Brisbane.

ON THE MODE OF BIRTH OF THE KANGAROO, COMMUNICATED BY THE HON. L. HOPE, WITH REMARKS ON THE ECHIDNA AND PLATYPUS.

BY J. BANCROFT, M.D.

President of the Queensland Philosophical Society.

(*Read 22nd June*, 1882.)

Though the peculiarities of the generation of marsupials have been studied for about fifty years, there are yet many points that require elucidation before the whole process is clearly comprehended. The reproduction of placental mammalia has been under the eye of civilized nations for ages, and so presents no difficulties, so to speak; but on the exploration of Australia the fauna of this continent show forms of life, new and strange, that require special study before their life history can be understood.

Professor Owen did much to clear up the strange anomalies of marsupial generation, between the years 1830 and 1840, since which little has been added; and, in a conversation with him some five years ago, he remarked that many material points yet remained in the history of the Echidna, the Platypus, and the Kangaroo, which he did not expect would be discovered during his life. I take this opportunity to bring before the Philosophical Society some observations made by the Honourable Louis Hope, of Cleveland, of the efforts made by the embryo kangaroo to arrive at the pouch of its mother.

As Professor Owen was unable to witness this act, he "*was led to believe that the mode of removal of the young from the vulva to the pouch was by the mouth of the mother.*"—*Encyclopædia of Anatomy and Physiology; Article, Marsupialia.*

Though the observations now submitted do not go far enough, they may lead to further examinations of this interesting point. Referring to the article above quoted, the Honourable L. Hope writes to me:—

"I had seen the account long ago, and expected that since that time more definite information had been elicited on the subject. My observations have reference only to the mode of transference of the embryo to the pouch, which I now believe to be effected by the embryo itself; or, at any rate, with very little assistance from the mother, and that almost unconsciously given.

"I heard lately of an instance of the same appearances having been observed by a kangaroo hunter, and was pleased to find the confirmation of his story by my own experience.

"His opinion was that the embryo had been extruded by the dam in its dying agonies, and described almost exactly what I afterwards saw—viz., that the embryo was working its way through the fur straight towards the orifice of the pouch.

"The dam that I shot had been dead, perhaps, five minutes before I noticed what was going on, but I don't think sufficient time had elapsed for the young one to have made its way so far. It was then within about five inches of the orifice of the pouch, or where that should have been, as on examination this appeared to be closed, being surrounded by folds of shrunken skin (not open, as in Professor Owen's case).

"The embryo looked like—and, in fact, at first I took it to be—a piece of raw flesh, which I supposed had been driven out by the bullet; but closer inspection showed it to be working actively with its fore legs—arms, in fact—which were considerably developed, with the claws apparent. It was about one and one-third inches in length, the tail and hind legs undeveloped, and giving the hinder parts of the animal the appearance of a red 'grub.' After watching it a few minutes, and not having much time to remain, I took it from the fur, to which it seemed to adhere pretty firmly, and placed it on the closed orifice of the pouch. It soon left this, however, and commenced travelling through the fur, which was pretty long, with considerable energy: as, however, it began to describe circles, and appeared, as I may say, rather to have lost its way, after a few minutes more I placed it again on the supposed orifice of the pouch, taking care that the head sunk among the folds of the skin I have mentioned. It then seemed to endeavour to burrow in. At this stage I had to leave it, as the day was advancing, and I had an engagement elsewhere. Had I had the means of preserving it I would have removed the skin of the abdomen, including pouch and the embryo, and brought it away; but it appeared to me that, as after death no assistance could come from the dam, no further reliable observations could be made. My theory is that in life the irritation produced by the burrowing of the young one causes the pouch to open for its reception; and this is just what can only be observed in the captivity of the animal. What struck me was the marvellous energy and apparent endurance of the embryo in its course, and the small chance there seemed to be of its falling from the fur, which, while producing adherence, did not seem to impede its progress materially.

"I can quite believe that it may work in this way for hours before effecting an entrance."

Now we have sportsmen who kill scores of marsupials daily, the above communication may lead to further observations on this interesting point.

With regard to the form in which the young of the Echidna and Platypus are born, nothing is certainly known—whether included in an egg, or more probably as an egg bursting on extrusion, much as one witnesses in the little British lizard kept in vivaria.

The protection given to the young by the Platypus differs from the Echidna. The former has a nest in the river bank, and has no pouch in which it can carry its young.

I am not aware that the Echidna ever makes a regular nest; it can form a pouch in which to carry its young, though of this latter more observation is required.

The abdominal integument in the quiescent state is generally flattened out, but by an effort on the part of male or female a pouch can be formed much like that of the kangaroo. This I have seen when giving these animals chloroform, to enable me to unroll them, and when experimenting on them with the Pituri of the aborigines.

In this pouch the apertures of the milk glands are found. The glands themselves are of immense size, occupying the whole of the side of the body from the front to the hind leg. They are placed under the muscular layer which enables the animal to roll itself in a ball, by the contraction of which muscle the milk is also pressed out at the will of the mother, as there are no nipples.

It would be interesting to find out what attitude the Echidna assumes in suckling its young. In lying on its back the milk would fill the pouch referred to as a cup.

The tongue of the Echidna is a long skewer-like organ, which moves with surprising swiftness. A tame Echidna I once had was very tractable, and would feed under observation—a thing that rarely happens with these timid creatures. It would thrust its tongue out about three inches, passing it through and through the milk given to it, like a small eel. As the fluid was reduced bits of chopped egg in the milk were as if hooked into its mouth. The most remarkable observation I made was on an Echidna recently killed by a wood-carter. On dissection its stomach was full of milk. Though of adult size it was a young animal; its claws being perfect and uninjured. The claws of old Echidnas are more or less deformed by digging, at which operation no animal of its size is so able. I am of opinion that the young Echidna takes milk from its mother until it is full-grown. On confining an Echidna in a box one is astonished to find that the animal invariably breaks loose through wood or wire—even a zinc-lined case is not proof against its powers of penetration. Persons trying to tame Echidnas, and render them tractable, should first have constructed a well-made movable cage of inch-thick boards, the front of which may be closed with wire of half-inch mesh, made very strong, with fencing wire woven through every two inches of its area. As the excretions are very offensive, a layer of dry earth an inch thick should be used every few days to the bottom of the cage. The feeding cup should be placed outside the wire, so that the vessel may not be upset. The Echidna swims very well when put into water. A specimen of Echidna setosa (an albino) has been recently presented to the Museum by Baron Von Müeller.

The observations of Dr. Bennett, and of his son, Mr. Bennett, of the Lands Department, at Toowoomba, have done much to explain the mode of life of the Platypus.

The Platypus and Echidna being intermediate in their anatomy between birds and mammals, and the only surviving animals in this group, the particulars of their mode of generation are especially interesting to naturalists.

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